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Fossils as Drugs: pharmaceutical palaeontology

Christopher J. Duffin

Luxembourg, 2008

Travaux scientifiques du Musée national d'histoire naturelle Luxembourg

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Fossils as Drugs: pharmaceutical palaeontology

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Keywords: history, medicine, belemnite, *Balanocidaris*, *Lepidotes*, amber

Abstract

An extensive examination of classical, Anglo-Saxon, Mediaeval and Renaissance records shows that palaeontological material was used, sometimes alone and sometimes combined with a wide array of other geological and botanical ingredients, to try to treat a surprising diversity of ailments from at least the 1st century well into the 18th century. Lyncurium or Lapis Lincis, for example, was reputed to be formed from lynx urine. Variously identified as amber, tourmaline and hyacinth (zircon), extant specimens from 18th century pharmaceutical cabinets indicate that belemnite guards were prescribed as Lyncurium. Records show that it was used to treat a wide range of conditions, including scrofula, malaria, digestive, ocular and renal disorders. Lapides Judaici or Jew's Stones are fossil cidaroid echinoid spines, often belonging to *Balanocidaris*, and were sucked or taken as a powder in cases of bladder stones and a number of related renal conditions. Bufonites or Toad Stones, believed to have been extracted from the heads of old toads, are actually fossil durophagous fish teeth, mostly belonging to the Jurassic semionotiform, *Lepidotes*. Employed in the treatment of a wide range of diseases, they were also set in rings and used as antivenin prophylactics. Amber has a long pedigree as a medicinal ingredient and was prescribed for ailments ranging from vertigo and cramp to gonorrhoea, mental illness and the plague. It was crushed and taken in tablets, distilled to yield Oil of Amber, and processed with Spirit of Wine to obtain Tincture of Amber. Fumes sublimated on the sides of the retorts gave rise to Salts of Amber. Inhaling the fumes released from burning amber was believed to be effective against respiratory problems and to ease childbirth.

Mots clés: histoire, médecine, bélemnites, *Balanocidaris*, *Lepidotes*, ambre

Résumé

Un examen approfondi des sources classiques, anglo-saxonnes, médiévales et de la Renaissance, montre que le matériel paléontologique était utilisé au moins depuis le 1er siècle de notre ère jusque tard dans le 18ème siècle, parfois isolément, parfois combiné à un tas d'autres ingrédients géologiques et botaniques, pour traiter un éventail surprenant de maladies. On pensait que le Lyncurium ou Lapis Lincis était formé par l'urine de lynx. Avec différentes identifications, comme ambre, tourmaline ou hyacinthe (zircon), des spécimens provenant d'officines pharmaceutiques du 18ème siècle indiquent que les rostres de bélemnites étaient prescrits comme Lyncurium. Les archives montrent qu'on l'utilisait pour traiter de multiples pathologies, dont la tuberculose, la malaria, des maladies digestives, oculaires et rénales. Les Lapides Judaici ou Pierres des Juifs sont des radioles d'oursins fossiles cidaridés, souvent du genre *Balanocidaris*; ils étaient sucés ou ingurgités en poudre contre les lithiases urinaires et d'autres pathologies urologiques. Les Bufonites ou Pierres de Crapauds, considérées comme provenant de têtes de crapauds âgés, sont en fait des dents de poisons fossiles durophages, principalement du genre de sémionotiforme jurassique *Lepidotes*. Employées dans le traitement d'une large variété de maladies, elles étaient aussi montées en bagues et utilisées en prophylaxie dans les envenimations. L'ambre a une longue histoire comme ingrédient médicinal, il était prescrit dans des pathologies allant des vertiges et crampes jusqu'à la gonorrhée, les maladies mentales et la peste. Il était broyé et ingurgité en comprimés; distillation produisait l'Huile d'Ambre et mélangeant avec Esprit du Vin produisait la Teinture d'Ambre; les fumées sublimées sur les parois des cornues engendraient les Sels d'Ambre. L'inhalation des fumées libérées en brûlant de l'ambre était censée efficace contre les problèmes respiratoires et pour faciliter l'accouchement.

Schlüsselwörter: Medizingeschichte, Belemnit, *Balanocidaris*, *Lepidotes*, Bernstein

Zusammenfassung

Eine intensive Untersuchung klassischer angelsächsischer Berichte des Mittelalters und der Renaissance zeigt, dass paläontologische Gegenstände, teils allein, teils kombiniert mit einer großen Zahl anderer geologischer und botanischer Ingredienzien, seit mindestens dem ersten bis weit in das achtzehnte Jahrhundert hinein benutzt wurden, um eine überraschende Vielzahl von Beschwerden zu lindern. Von Lyncurium oder Lapis Lincis glaubte man, dass es aus dem Urin des Luchses entstanden sei. Verschiedentlich als Bernstein, Turmalin oder Hyazinth (Zirkon) identifiziert, zeigen noch vorhandene Exemplare aus pharmazeutischen Sammlungen, dass Belemniten-Rostren als Lyncurium verschrieben wurden. Berichten zufolge wurde es benutzt, um ein weites Spektrum an Krankheiten zu behandeln wie Skrofulose, Malaria, Verdauungs-, Seh- und Nierenstörungen. Lapides Judaici oder Judensteine [plural] sind fossile Seeigelstacheln, häufig von *Balanocidaris*, die im Fall von Blasensteinen und einer Reihe weiterer Beschwerden des Nierensystems gelutscht oder als Pulver genommen wurden.

Bufonites oder Krötensteine, von denen geglaubt wurde, dass sie aus den Köpfen alter Kröten stammen, sind in Wirklichkeit fossile Zähne durophager Fische, meist der jurassischen semionotiformen Gattung *Lepidotes*. Angewendet bei der Behandlung einer Vielzahl von Beschwerden, wurden Bufonites auch in Ringe gefasst und als prophylaktisches Gegengift getragen. Bernstein hat eine lange Geschichte als medizinische Ingredienz. Er wurde verschrieben bei unterschiedlichsten Beschwerden und Krankheiten, bei Schwindel, Krampf, Gonorrhö, Geisteskrankheit und gegen die Pest. Er wurde zerstoßen und als Tablette genommen, er wurde einmal destilliert, um Bernsteinöl zu erhalten, ein zweites Mal, um Bernsteintinktur zu gewinnen. An den Seiten von Retorten sublimierter Rauch ergab Bernsteinsalz. Die Inhalation von Rauch brennenden Bernsteins sollte hilfreich sein bei Atemproblemen und die Geburt erleichtern.

Parola chiave: storia, medicina, belemniti, *Balanocidaris*, *Lepidotes*, ambra

Riassunto

Un'ampia indagine condotta su documenti classici, anglosassoni, .i e rinascimentali ha rivelato che materiale paleontologico era usato, da solo o talvolta combinato con numerosi altri ingredienti di origine minerale o vegetale, per cercare di curare una sorprendente varietà di malattie, almeno dal I secolo e fino a tutto il XVIII secolo. Si riteneva ad esempio che il lincurio o pietra della lince (lapis Lincis) derivasse dall'urina di lince. Tale rimedio veniva identificato variamente come ambra, tormalina e giacinto (zircone), e campioni ancora esistenti, contenuti in armadietti dei medicinali del XVIII secolo, suggeriscono che anche rostri di belemniti erano prescritti come lincurio. La documentazione rivela che il lincurio era usato per curare un'ampia varietà di condizioni, incluse scrofola, malaria, malattie digestive, oculari e renali. Il Lapis Judaicus o pietra giudaica consisteva in spine di echinoidi cidaroidi fossili, spesso appartenenti al genere *Balanocidaris*, e queste erano succhiate o somministrate sotto forma polverizzata in caso di calcoli alle vie urinarie e in varie affezioni renali. Le bufoniti o pietre del rospo, che si pensava fossero estratte dalla testa dei rospi, sono in realtà denti di pesci durofagi fossili, soprattutto appartenenti al semionotiforme *Lepidotes* del Giurassico. Utilizzate nella cura di numerose malattie, esse erano anche montate su anelli e usate nella prevenzione di avvelenamenti. L'ambra ha una lunga storia come ingrediente medicinale e fu prescritta per varie malattie, dalla vertigine, ai crampi, alla gonorrea, a patologie mentali e contro la peste. Essa veniva triturata e somministrata in compresse, oppure veniva distillata per ottenere l'olio di ambra, o ancora posta in alcool per ottenere la tintura di ambra. I fumi sublimati sulle pareti delle storte permettevano di ricavare i sali di ambra. Si pensava che l'inalazione dei fumi rilasciati per combustione dell'ambra fosse efficace contro problemi respiratori e per facilitare il parto.

1. Introduction

1.1 National Museum of Natural History Luxembourg Collections

There have been a number of recent studies and revisions and much active cataloguing of the fossil collections housed in the National Museum of Natural History Luxembourg (MnhnL; see, for example, Delsate, 1999; Delsate, Duffin & Weis, 1999, 2001, 2002; Weis 1999, 2006; Weis & Delsate, 2005; Thuy 2003; Thuy *et al*. 2005). This work has also provided an opportunity to consider some specimens in a wider ethnological and historical context. The present paper surveys the medicinal applications of a number of fossils which were well known in classical, mediaeval and renaissance times, and which are also well represented in the National Museum of Natural History Luxembourg collections. The current study focuses on amber, echinoid spines, the palatal teeth of the semionotiform fish *Lepidotes*, and belemnites. The museum contains a large number of amber specimens (e.g. Fig. 30), many containing insect inclusions, particularly from the Eocene of the Baltic area, and numerous echinoid radioles (the Jurassic echinoderms of the Lorraine are currently being studied by Ben Thuy, see Thuy 2003; Thuy et al. 2005). The Toarcian (Lower Jurassic) deposits of Luxembourg have yielded many specimens of *Lepidotes elvensis*, most of which are fully articulated with nicely preserved dentitions. Furthermore, the Belgian and Luxembourg Lorraine has yielded significant discoveries of early Jurassic (Hettangian) representatives of the Belemnitida (Delsate, Duffin & Weis, 2002; Weis & Delsate, 2005), and the Museum also boasts many belemnites from Sinemurian to Bajocian sediments (Keut & Jagt, 1998).

In addition to the library of the Wellcome Museum for the History and Understanding of Medicine (London), the Luxembourg Archives de l'Institut Grand-Ducal des Sciences Naturelles, Mathématiques et Physiques, the Bulletin de la Société des Naturalistes Luxembourgeois, and the Bulletin de la Société des Sciences Médicales were searched for any mention of the use of fossils by Luxembourg authors and medical practitioners. This search and the paper by Harpes (1954) failed to reveal any contemporary record of the medicinal use of fossils in the Luxembourg Pharmacopoeia. On the contrary, it would appear that zootherapy has dominated Luxembourg materia medica; data is only available for the use of Recent animal parts in the preparation of medicines and simples (Thèves, 2000). As a consequence, the present paper records only the foreign uses of fossil material which is nevertheless exemplified by a wide range of specimens housed in the Luxembourg Museum collections.

1.2 Fossils as therapeutic agents: a note on sources

The fact that palaeontological materials have been used medicinally from classical to modern times is well established and often alluded to in general texts and more specialised works dealing with the historical, cultural or folklore aspects of fossils (e.g. Abel 1939; Annoscia 1981; Thenius & Vávra 1996; Bassett 1982; Oakley 1978,1985; Kunz 1915; Lüschen 1979; Rätsch & Guhr 1989; Gregorová 2006). There have been few studies dedicated solely to the medicinal uses of geological materials; Duffin (2005) has considered mineral and fossil material from the western lapidary tradition, whilst an overall view of the uses of fossils has been given by Kennedy (1976), largely distilled from Oakley (1965).

A surprisingly rich fund of information on the medicinal uses of fossils can be gleaned from a diversity of manuscript and early printed sources. Occasional very early and often multiple copies of the works of classical authors such as Theophrastus and Pliny, as well as herbals, mediaeval bestiaries and lapidaries, including those written by Hildegard von Bingen, Albertus Magnus and Marbode of Rennes, are scattered through european libraries. With the advent of printing in the late 15th century, many of these works were made available to a wider readership. With the increasing accessibility of knowledge through rapidly, and relatively cheaply produced books, there was an expanding market for the dissemination of information. Language was no barrier, as a publishing industry sprang up dedicated to the translation of texts in Latin and a variety of European languages into English, French and German. Mediaeval and Renaissance authors usually had an eclectic and encyclopaedic approach to the gathering and systematic processing of information.

Often relying heavily on earlier published authorities, together with a smattering of colloquial and local lore, the Materia Medica became an indispensable component of the physician's armoury in the fight against sickness and disease. Largely dedicated to the healing properties of plant materials, they nevertheless contain a wealth of information on the uses of fossils, minerals and earths in a lineage that extends from Dioscorides in the second century A.D.

The philosophy of natural science and medical practice was based firmly on Aristotelian principles which saw four properties or elements (heat, cold, dryness and dampness) as the essence of material things. Useful summaries of these principles are given by Adams (1938) in relation to geology, and Rawcliffe (1999) in relation to medicine. In the human body, four humours were believed to correspond to the Aristotelian elements, and good health could only be achieved by maintaining them in a careful balance. The humoural types were identified as choleric, phlegmatic, melancholic and sanguine. If the humours became unbalanced because of a failure of different parts of the anatomy to carry out their functions, then a diseased state ensued. Restoration of health could be achieved by taking natural remedies with appropriate properties, as identified in early herbals.

Out of a repository of interpretation of the medicinal value of individual plant, animal and geological materials grew the combinations of ingredients that made up the recipes for an enormous variety of drugs. These 'simples' (a name given both to individual herbs and the mixtures made from them) were gathered together in compendia from the times of Galen (2nd and 3rd centuries AD), through the leechbooks of the Anglo-Saxon period, mediaeval herbals and lapidaries to the more familiar pharmacopoeia of recent times. Renaissance and later works often contain precise details of the means of production and relative proportions of the ingredients in these drugs, together with suggestions as to dosage and application. They usually adopt one of two general approaches to the subject – drug classification by disease or affliction, or arrangement by individual constituents. The latter began to be progressively replaced by the former as the volume of available information began to expand from the 15th into the 16th centuries.

Three pharmacopoeia dominated 17th century medicine. One was written by an Englishman, Nicholas Culpeper (1616-1654). The other two were penned by French druggists, namely Moses Charras (also spelt Moyse Charas; 1619-1698), who was Louis XIV's "Chief Operator" at the Jardin des Plantes (Charras 1678), and Pierre Pomet (1658-1699).

1.3 Pierre Pomet

Pierre Pomet (Figure 1) was born in Paris on 2nd April, 1658. In his early life he travelled extensively – to Italy, Holland, Germany and England. His Grand Tour allowed him to collect recipes for medicaments and simples. On his return to Paris, he opened a druggist's shop and quickly made both an excellent living for himself and his family, and an increasingly impressive reputation amongst the French medical community. He first

Fig. 1: Portrait of Pierre Pomet (1658-1699), apothecary to Louis XIV. Reproduced with the kind permission of the Wellcome Library for the History and Understanding of Medicine.

wrote his "Histoire Générale des Drogues" in 1694. It appeared in a folio edition, later to be republished in a new edition as two quarto volumes in 1735. The original version was translated firstly into German and published at Leipzig in 1717, and then into English, expanded with additional information from other authors, for publication in London in 1725. A mark of Pomet's authoritative position and success was the royal invitation to demonstrate his drugs at the Jardin des Plantes. Then, Pierre Pomet died quite suddenly on the 18th November, 1699, the very day that Louis XIV announced the award of a royal pension for the apothecary, leaving his son, Joseph Pomet to oversee publication of the second edition of his work.

Pomet's "Histoire Générale des Drogues" is justly famous for a number of reasons, not the least of which are his well researched, down to earth and extensive accounts of the unicorn and the medicinal uses of Mumia – mummies. His magnum opus is divided into three parts. Livre 3 is concerned with "Fossils, Minerals and Bitumens", and includes details of the medicinal uses of Hyacinth, Topaz, Emerald, Sapphire, Ruby, Lapis Lazuli, Armenian Stone, Smalt or Powder Blue, Jasper, Jade, Nephritick stone, Venetian Talc, Briancon Chalk, Spalt or Spaad, Bolognian Stone, Pumice stone, Aetites (the Eagle Stone), Lapis Amiantus (Asbestos?), Cobalt and Osteocolla or the Bone-Binder. Scattered amongst these minerals, rocks and earths are, in addition, four samples of fossil material – amber, Lapis Judaicus (Jew's Stone), Lapis Lincis (Lynx Stone) and the Toad Stone.

Whilst other fossils do figure in earlier pharmacopoeia, it is true to say that these four appear the most consistently with an almost unbroken pedigree from classical times through to the 18th century. The anonymous English translator (Pomet 1737:182; although it may have been Sir John Hill) of Pomet's work states that Toad Stones were not in use at the time, and that "The Vertues ascribed to them seem altogether imaginary". Lapis Lyncis "is said to be a powerful lithontriptick, but is never used at present", and the Lapis Judaicus "are little used at present" (Pomet 1737:179). In spite of these statements, Pomet (1695) listed all four, plus numerous other fossils, minerals and rocks in his catalogue of drugs and simples from his own personal cabinet. The late 17th and early 18th centuries therefore represent a time when the use of fossil materials in medicine was declining. This paper will give an initial brief and fairly cursory overview of these four fossils – their identity, origins and uses as an introduction to one of the forgotten means of employment of palaeontological material in the early history of geology.

2. Lapis Lincis

2.1 The Greeks

The earliest reference which we have to the Lynx Stone, also referred to as Lyngurium, is that ascribed to Theophrastus (372-287 BC), native of the Greek island of Lesbos and fellow student with Aristotle under Plato. He probably wrote "De Lapidibus" ("On Stones") around 315 BC whilst he was leader of the Lyceum following Aristotle's expulsion from Athens (Walton 2001). "De Lapidibus" was not translated from Greek into Latin until the late fifteenth century (Walton 2001:359) and was first rendered into English by Sir John Hill (c.1716 - 1775) in 1756, with later translations by Caley & Richards (1956) and Eicholtz (1965). The text entry for Lyngurium reads as follows:

> The lyngurium, which is carved into signets and is hard as any stone, has an unusual power. For it attracts other objects just as amber does, and some people claims that it acts not only on straws and leaves, but also on thin pieces of copper and iron, as Diocles maintained. The lyngurium is cold and very clear. A wild lynx produces better stones than a tame animal, and a male better ones than a female, there being a difference in the diet, in the exercise taken or not taken, and, in general, in the natural constitution of the body, inasmuch as the body is drier in the case of the former and more moist in the case of the latter. The stone is discovered only when experienced searchers dig it up, for when the lynx has passed its urine, it conceals it and scrapes soil over it.

It has been suggested that the description might refer to amber (note the origin as lynx urine, which is yellow in colour, and the property of static electricity) in spite of the reference to it being *like* amber and therefore distinct from it. Eicholtz (1967:108) argues in favour of yellow and brown

varieties of tourmaline as candidates for the stone (see also Watson 1760:396), while Kunz (1913: 295) suggests that jacinth (usually identified as a red, transparent zircon, also known as hyacinth; Duffin 2006b:12) and sapphire might have been included.

Theophrastus' reference to the opinions of Diocles makes it clear that there was already a tradition to draw upon at the time of writing "De Lapidibus". Irrespective of the original identity of the Lyngurium, comments on the stone quickly became established in classical literature. Solinus (circa 240 A.D.; Riddle 1977:111) for example, largely reiterated Theophrastus.

The earliest use of Lyngurium in medicine is reported by Damigeron (Tahil 1989), who was, according to Tertullian (c.150 - c.223)(Tahil 1989: vi), a magician in the second century B.C. The centurion, Lucinius Frontinus, having delivered numerous gifts to Evax, the King of Arabia, from Tiberius (Emperor of Rome from 14 to 37 A.D.) was given in return a document in which was recorded "everything there is in the world about all kinds of remedial stone" (Tahil 1989:4). Within this store of knowledge, "De Virtutibus Lapidum" ("The Virtues of Stones"), the efficacy of Lyngurium is made clear:

> The stone Lyngurus or Lynguro is the best stone for safety at home, and keeps pregnant women and children from being afraid. Worn, or ground up in wine and drunk it also keeps the King's Evil away.

The manner of preparation in this case recalls other medicines made from amber. The King's Evil, mentioned in the passage, refers to the condition known historically as scrofula. This disease-state was only vaguely defined; the primary symptoms seem to have been enlargement and attendant putridity of the lymph nodes, particularly in the neck, often associated with open facial sores. It has been suggested that much of what was ascribed to scrofula (several types were recognized by the Middle Ages) was bovine tuberculosis (Kiple 1997:44), contracted through the drinking of infected milk. The name "King's Evil" was coined in response to the conviction that the condition could be cured by the touch of a King, a practice which seems to have begun with the return of Louis IX of France from the Crusades in 1254 (Kiple 1997:45).

In an interesting etymological dichotomy, Damigeron also refers in his treatise to the stone, Lincis:

> Cut it into two parts in milk and honey, then take it and set it in a ring and if you wear it wherever you go and whatever you do, you will be joyful and glad.

2.2 Pliny

Gaius Plinius Secundus, the Elder Pliny (23-79 AD), victim of the classical eruption of Vesuvius, was an indefatigable scholar and encyclopaedist. He compiled, in a fairly eclectic manner, enormous quantities of folklore and wisdom, often from the writings of precursors and contemporaries, into his 37 volume "Historia Naturalis", the 36th Book of which was dedicated to Stones. Pliny was not impressed by what he had read about Lyncurium, recounting:

> It is the obstinacy of our authorities that compels me to speak next of lyncurium, since, even when they refrain from asserting that this lyncurium is amber, they still claim that it is a gemstone, stating that it is formed indeed from the urine of the lynx, but also from a peculiar form of earth. They say that the creature, bearing a grudge towards mankind, immediately conceals its urine, which forms a stone in the same place. The stone is said to have the same fiery colour as amber, to be capable of being engraved and to attract not merely leaves or straws, but also shavings of copper and iron, a belief which even Theophrastus accepts on the authority of a certain Diocles. I for my part am of the opinion that the whole story is false and that no gemstone bearing this name has been seen in our time. Also false are the statements made simultaneously about its medical properties, to the effect that when it is taken in liquid it breaks up stone in the bladder, and that it relieves jaundice if it is swallowed in wine or even looked at.

Ovid (43 BC - 17 AD), however, was content to reiterate the legend of the origins of the Lapis Lincis in his "Metamorphoses" (Book XV lines 413-415; Melville 1987:364), writing:

> Vine-wreathed Bacchus
> Received from conquered India a gift

> Of lynxes, beasts whose urine, so men say,
> Changes to stones, congealing in the air.

Dioscorides (circa 40 – c. 90 AD) is as doubtful as Pliny as to the supposed origins of Lyngurion (Book II, 100) in making the following entry (Gunther 1968:124) in his section on urine:

> But that [urine] of the Lynx, which is called Lyncurium, is thought as soone as it is pist out, to grow into a stone, wherefore it hath but a foolish report. For it is this that is called by somme Succinum pterygophoron [because it draws feathers to it], which being dranck with water is good for the stomach & for a belly that is troubled with a flux.

2.3 The Lynx and the Bestiary

Although now largely restricted to fairly small populations in Greece, Eastern Europe, the Iberian Peninsula, Scandinavia and Russia, the Lynx (*Felis lynx*) was once a virtually pan-european nocturnal carnivore. Up to 1.3m in length with a black-tipped short tail, it has characteristic dark spots over the otherwise greyish to reddish-brown, relatively long-haired coat, and black tufts of hair projecting from the ear tips. The essence of the animal is captured in some of the earlier woodcuts and copper engravings by Gesner (1699; Fig. 2a), Worm (1655), Topsell (1658) and Jonstonus

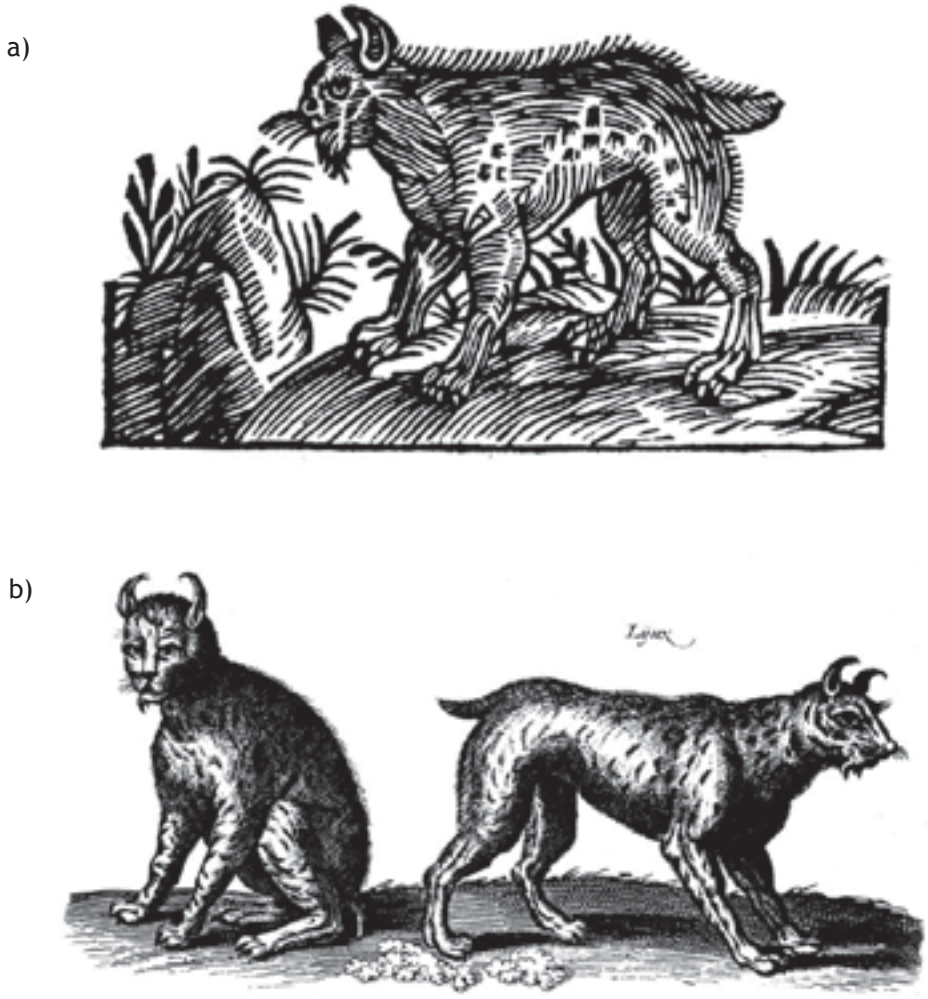


Fig. 2: Early representations of the European Lynx (*Felis lynx*). a) according to Gesner (1699:354); b) from Merian (1718).

a)

b)

Fig. 3: The lynx voiding a lyncurium from mediaeval bestiaries. a) Bodleian Library MS Douce 88ii folio 8 recto; b) Bodleian Library MS Bodley 764 folio 11 recto. Reproduced by kind permission of the Bodleian Library, University of Oxford.

& Ruysch (1718; Figure 2b). In mediaeval times, English writers were unfamiliar with the animal, which was unknown in Britain, although by 1252 a specimen was part of the royal collection at the Tower of London (George & Yapp 1991:49; Hahn 2003)(although note that William of Malmesbury (circa 1090-1143) records the presence of lynxes in the royal collection of Henry I at Woodstock around 1110; Hahn 2003).

The Lynx is not universally portrayed in mediaeval bestiaries, but much is made of the idea that its

urine turns to stone. One bestiary manuscript (Bodleian Library MS Douce 88ii f.8r) illustrates a lynx urinating, while its stream lithifies beneath it (George & Yapp 1991:49, fig. 25)(Fig. 3a). A similar portrayal is found in a second manuscript bestiary (Bodleian Library MS Douce 88i) where a high standing, hoofed lynx emits a jet of urine which turns to stone beneath its belly, while in a third (Bodleian Library manuscript Bodley 764 f.11r) the animal guards a stone between its hind legs (Barber 1992; Fig. 3b). A lynx depicted in a fourth bestiary manuscript (Sloane 3544 in the British Library) quickly covers its stone while being chased by a man. One bestiary (White 1956:22) states that:

> They say that his urine hardens into a precious stone called Ligurius, and it is established that the Lynxes themselves realize this, by the following fact. When they have pissed the liquid they cover it up in the sand as much as they can. They do this from a certain constitutional meanness, for fear that the piss should be useful as an ornament to the human race.

An abridged English version of Johannes de Cuba's (1473) "Hortus Sanitatis" ("Garden of Health") was published in Antwerp around 1521 under the title "The Noble Lyfe & Natures of Man of Bestes Serpentys Fowles and Fishes" (Hudson 1954). The lynx appears in a coarse woodcut with the comment "his pisse baketh in ye sonne and that becommeth a ryche stone" (Hudson 1954:54; Fig. 4).

Corupted is the lintworme as of the kynred of ye wolf, but it hath upon his bake manu spottes like ye beste pardus [the leopard], & he is so sharpe sighted tht he seeth throughout a manes body & is fast & solid. And he hath a tong like a serpent but it is moche greater in su the quantitie that he casteth it about his necke, & hath cloven fete with gret clawes & his pisse baketh in ye sonne and that becommeth a ryche stone

Fig. 4: Representation of the Lynx and accompanying text from "The Noble Lyfe & Natures of Man of Bestes Serpentys Fowles and Fishes" (Hudson 1954:54). The text reads: Corupted is the lintworme as of the kynred of ye wolf, but it hath upon his bake manu spottes like ye beste pardus [the leopard], & he is so sharpe sighted tht he seeth throughout a manes body & is fast & solid. And he hath a tong like a serpent but it is moche greater in su the quantitie that he casteth it about his necke, & hath cloven fete with gret clawes & his pisse baketh in ye sonne and that becommeth a ryche stone.

2.4 Mediaeval lapidaries

As with so many minerals, gems and fossils recorded in the classical works of Theophrastus, Dioscorides, Pliny etc., the mediaeval lapidary tradition reiterates the wisdom of earlier authors, sometimes conflating information from multiple sources, and occasionally embellishing entries with new observations or applications. As Walton (2001) has shown, citations of Lyngurium have reflected considerable confusion amongst lapidary authors.

Hildegard von Bingen (1098-1179), born the sickly 10th child of a noble family, was tithed to the church. She rose to become abbess of a monastery on Rupertsberg at Bingen on the Rhine, and is famous for her visionary life, music and writings. She refers to the lyngurium in her "Das Buch von den Steinen" (Riethe 1997:110), indicating that, if soaked in wine, water or beer for 15 days, and then taken after a small breakfast, the stone will cure chronic stomach-ache. If the patient is suffering from dysurea (painful or difficult urination), the stone can be soaked in warm (but not boiling) cow's or sheep's milk (but not goat's milk), which should then be sipped. She records its power as being so great that, if taken for any illness other than those two for which it is expressly prescribed, it would stop the heart of the patient and shatter his skull.

Marbode (1035-1123), Bishop of Rennes (1061-1081) famously wrote an alphabetical lapidary in verse, consisting of 734 Latin hexameters describing 60 stones. His description of Lyncurium repeats Pliny's suggestion of offering a cure for jaundice, but adds digestive problems to the gradually expanding list of ailments against which the stone is reputed to be effective (King 1860:404):

Voided by lynxes, to a precious stone
Congealed the liquid is Lyncurium grown;
This knows the lynx and strives with envious pride
'Neath scraped up sand the precious drops to hide.
Surpassing amber in its golden hue
It straws attract if Theophrast says true:
The tortured chest it cures, their native bloom
Through its kind aid the jaundiced cheeks resume;
And let the patient wear the gem, its force
Will soon arrest the diarrhoea's course.

Albertus Magnus, a Dominican friar who died in 1280, wrote his comprehensive and influential lapidary, "De Mineralibus", around 1260 (Wykoff 1967), and referred to stones in many of his other works. He subscribed to what has become known as the Doctrine of Form or the Doctrine of Signatures – that the shape, colour and appearance of natural objects give an indication as to their potential use for mankind (see further comments below, section 2.5). His comments on Lyngurium in "De Mineralibus" closely follow those of Marbode, but in his "Book of Secrets" (Magnus 1252; Best & Brightman 1973:48) there is much confusion:

> Isidore seemeth to say that Licania hath in the head a stone of most noble virtue, and is of white colour; which, brayed, given to them that have the strangury to drink, it looseth perfectly the urine, and shortly healeth it, and putteth away the fever quartan. Also it taketh away a white spot or pearl in the eye. Also if a woman with child bear it on her she shall not lose her birth. Also the flesh of them sodden and eaten is good to them that have exulceration, or sore in the lungs, with a consumption of all the body, and spitting of blood. Also, the powder of the beasts, with the rind of bark of trees, with some grains of pepper, is profitable against the haemorrhoids and growing out of flesh about the buttocks. Likewise they being raw, brayed with rind or barks of trees, break ripe impostumes.

The assertion that the stone grows in the head of the Lynx is novel, despite the ascription to Isidore (530-636, Bishop of Seville), who only made passing reference to Lyngurium in his "Etymologiarum" (Libri XX, XVI.8.8; Lindsay 1911); it recalls the supposed origins of the Toad Stone (see below, section 4.3). This account as to the origin of the stone persisted at least up to the mid-sixteenth century in some texts, such was Albertus Magnus's authority. For example, Bullein (1562: Book 1, fol. xxvii) reports it as being "ingendred of the brayn of Lynx".

Notice as well the new list of diseases recorded by Albertus Magnus which Lyngurium can be used to treat. "Strangury" describes the painful sensation of urinary urgency and frequency when the bladder is empty. "Quartain fever" refers to a type of malaria in which a fever was suffered every 72 hours, and the "White spot or pearl in the eye" may be a description of cataracts. The amuletic properties of the stone are also here expanded from the effectiveness against fear in pregnant women and young children cited in Damigeron, to protection against miscarriage and stillbirth.

The earliest pharmaceutical recipes containing Lapis Lincis which I have been able to trace began circulating in England during the thirteenth century (Hunt 1990). One "Sirop Contre la Pere" ('Syrup against the Stone', referring to Bladder Stones) uses the Lynx Stone as the only mineral ingredient amongst a plethora of botanical ones, including Gromwell, Fennel, Coriander, Caraway, "peresil macedoine" (*Smyrnium olusatrum*), Aniseed, Juniper, Greek nettle, Cinquefoil, Saxifrage, Burnet, Ash keys, Cherry stones, Aspic (an aromatic oil from *Lavandula spica*), white pepper, *Ciperus longus*, Bay leaves, Betony, Pimpernel, Valerian, Squinant or Camel's Hay (*Andropogon schoenanthus*), Oregano and Basil. All were crushed, mixed together and drunk in a draught of wine (Hunt 1990:328).

In a second recipe, for a powder effective against bladder stones, Lapis Lincis was used together with Armenian Stone (blue copper carbonate), Agate, Lapis lazuli (powdered and used as a colouring agent), as well as gold, silver and iron filings. These were mixed with musk, ambergris, oil of nard, "oil sanguine" and an assortment of plant material too long to list here (Hunt 1990:330).

Bladder stones were relatively common complaints in historical times, and endemic in north-west Europe. They have been proven archaeologically, associated with the skeletons of pre-dynastic Egyptian mummies, in Bronze Age, Roman and Dark Age burials and the famous Jebel Moya site in the Sudan, for instance (Brothwell 1967; Anderson 2001). Norfolk had the dubious distinction of being the English county with the highest incidence of bladder stone during the eighteenth century (Batty Shaw 1979:223). An analysis of the collection of stones extracted from 1498 patients at Norfolk and Norwich Hospital indicated that the highest incidence was amongst boys under 10 years of age (Batty Shaw 1970, 1979:224). Walter Carie (1580; unpaginated) explains the formation of such stones in children as being caused by their juvenile eating and boisterous exercise habits. His explanation is that children eat often and then they do "violent exercise" before digestion is complete "whereby they force a thicker and more grosse juice or nutriment from the stomach into the body, than nature requireth: and that grosse substance settling in the bottome of the bladder, by the temperature heat of the childe, is converted to a stone." He used the baking of clay as an analogy to illustrate how the calculi might form under the influence of body heat.

Buchan (1790:324), by contrast to many of the points identified above, accounted for the development of bladder stones as being due to:

> …. high living; the use of strong astringent wines; a sedentary life; lying too hot, soft, or too much on the back; the constant use of water impregnated with earthy or stony particles; aliments of an astringent or windy nature, &c. It may likewise proceed from an hereditary disposition. Persons in the decline of life, and those who have been much afflicted with the gout or rheumatism, are most liable to it.

Bladder stones were also extremely painful to bear. William Cheselden (1688-1752), a surgeon who famously pioneered new surgical techniques for the removal of bladder stones, records the case of a patient who suffered from them for over 8 years, eventually dying from the disease after a particularly distressing bout lasting over 6 weeks; the post-mortem revealed 214 stones in the bladder, weighing a total of over 170g (Cheselden 1746). One stone was removed after the death of a patient in East Anglia in 1662 and was found to weigh 964g (Batty Shaw 1979:222). The sense of hopelessness for victims of the conditon is captured poetically by the 16th century writer, Walter Carie as follows (Carie 1580):

Thy silver, gold, thy precious stone,
Thy mucke, thy worldlie wealth,
Nought helpeth now thy grievous grone,
No ease it gives, no health:

Now doth thou lie
Amidst thy friends a prisoner,
A piece of pining claie,
Thy hope for want of hearts desire,

Doth faile and fade awaie:
Thou seek'st to die
Thy friends eie tears, thy hart drops blood,
Thy lims and joints do quake,

Thy stomach vomits that is good,
Whose force makes bedsted shake:
An endlesse wo
Thy doleful life to thee is death,

And death were life to thee,
For paine doth cease with thy last breath,
And life heaps miserie.

Likewise, an ancient Italian poem by Ciri de Pers states (Kunz 1913:384):

"Other white stones serve to mark happy days,
But mine do mark days full of pain and gloom.
To build a palace or a temple fair,
Stones should be used; but mine do serve
To wreck the fleshy temple of my soul

Well do I know that Death doth whet his glaive
Upon these stones, and that the marble white
That grows in me is there to form my tomb."

Sir John Hill (1714-1775; Fig. 5) was apprenticed to an apothecary in the early 1730's, going on to work variously as a playwrite, actor, gardener, columnist, and herbalist (Wright 1933; O'Connor 2004). He gained an M.D. at St. Andrew's University, was honoured with the Order of Vasa for his botanical work by King

Fig. 5: Portrait of Sir John Hill (1714-1775)(a mezzotint by Richard Houston, after Francis Cotes, 1757), by kind permission of the National Portrait Gallery (NP D3047).

Gustav III of Sweden in 1774 (which he interpreted by using the title 'Sir') and developed into a prodigious author, often combining his medical and botanical interests. Whilst his publications were not always appreciated at the time, many give a valuable insight into medical practice and belief in the early eighteenth century. Thus, Hill (1759: 1) remarks that, "Human nature is liable to no Disease more terrible than the stone; nor are the lesser stages of that malady exempt from pain or danger." He goes on to describe the symptoms that mark the progressive onset of "the stone":

> 1. "a pain after making water; this is felt in the extremity of the part, which seems as if it were cut with a knife".
>
> 2. "a peculiar kind of colick, attended with an inclination to go to stool, but without the power of voiding anything."
>
> 3. "nausea and sickness of the stomach, a numbness down the thigh on that side where the stone lies, and a violent pain in the back."
>
> 4. "the pains in the back become intolerable; and the sickness causing a continual reaching and vomiting, all the other symptoms are aggravated, and in the end, without the assistance of medicines, or in spite of bad ones, a stone is discharged so large, that it gives pain in the passage, and is heard falling into the pot."

The formal medical treatment of last resort involved an operation known as a lithotomy. A humiliating and painful technique, this involved rectal probing of the stone followed by extraction through an incision in the perineum (Moore 2005; Lawrence in Bynum & Porter 1993). The Hippocratic Oath (circa 5th century BC) contains a paragraph referring obliquely to the hazards of surgical treatment of stones in the urinary tract (Edelstein 1943); Hippocrates indicates that he would defer to those more practiced than himself if surgery were indicated in such cases. Indeed, mortality rates from the procedure were as high as 40% in the 18th century, so it is little wonder that alternative treatments and prophylactics were sought so avidly (Duffin 2006c).

The London Lapidary of King Philip is an Old English rendition of a French lapidary from about 1325-1350, which was translated in turn from a Latin original (Evans & Serjeantson 1933:16). After the obligatory information about the origins of the stone, the lapidary adds some interesting details about its medicinal properties. The entire entry is reproduced below, with original spelling and syntax, for ease of reference:

> Ligure is a stone that is founde in ye lande of Inde vpon a flode ful of Ouenes that a best yt hight [lin]x kepeth, & hit holdeth in his throote ful depe, that ye virtues therof shulde not be helpynge to vs. The bokes tellen that ligures ben of many maneres, but the best is ye colour of golde, & swiche ther ben of colour of mirre, & some ther ben of colour of encens, and swiche ther ben that he yeueth ye yolow grenehed, & som ther ben / of colour of mylke, as a maistre deuised that hade a name Teopatus. Moyses seith us that ther ben some of ye colour of Iagounces. Oure lorde yaue that stone many virtues. He heleth ye Iaundys of man, & voideth vices, & is gode ayenis many maner goutes, &

> clenseth a man of all sorowes that nourished ben with-inne ye stommack. Ligure pleseth a man that is wrathful & gladith hym, & stauncheth menyson & bledyng woundes. The boke telleth vs that this stone is ful gode for ladyes, for the more thei shul be plesyng & loving. This stone colith a man of grete heete yef he put it in his mouth, & who-so wole touch his eyen therwith hit dryueth awey ye greuaunce & ye blode. & this stone hath ben named of many other names, but oure lord cleped hit ligure. Moyses seith that ye beest that kepith this stone diggeth ye erthe & parteth hit & with-holte hym with-inne ye graueile, & so kepeth ye ligure. Moyses clepeth this beest oxe, & ye vertue of this stone is in his lymmes & his strencthe in his nauel. The vertue of his lymmes, telleth vs Iob, this lecherous men ayeins their vices shulde haue ye vertue therof, that is chastite. The forseid beest that diggeth ye erthe to hyde his stone signifieth the oxes of Ihesu Xrist that his lande kepen & eryen & wynnen be holy predicacoun. The bible seith that this stone was first put in the thriddle corner vppon the brests of aaron, & signifieth ye gode precheurs of Ihesu Xrist than shulden come at thre tymes, that were ye tymes of the gospel.

The text introduces the idea, first mooted by Pliny (see above; but note Walton 2001:369) that the Lynx guards the stone fiercely against mankind. In fact, here, the animal secretes the solidified urine deep in the back of its throat to render it completely inaccessible to those who would seek it. The closely related North Midland Lapidary and the Peterborough Lapidary, both dating from the 15th century, tell the same story (Evans & Serjeantson 1933).

The reference to the fact that "Moses tells us that some are the colour of Hyacinth" links with the last sentence in the paragraph, where the stone is identified as one adorning the breast-plate of Aaron (Exodus 28), the Israelite priest. In Christian lapidaries the stone is consistently identified as the jacinth, a zircon or sapphire (gem variety of corundum) (see Kunz 1913:295 for a discussion of lyngurion in this context; see also Gesner 1565b leaf 8, leaf 22 verso). Similarly, the opportunity of using the stone as a Christian teaching aid is more typical of a bestiary (see, for example, Barber 1992:38). Indeed, the whole piece is steeped in the mediaeval Christian tradition – note that the range of colours includes those of gold, frankincense and myrrh, and that this information is erroneously cited as being from Theophrastus ("Teopatus"), who would have had to have anticipated the circumstances of Christ's birth by 300 years!

This lapidary is significant, however, in listing numerous ailments against which the Lapis Lincis was effective: jaundice, gout, depression, digestive ailments, heavy menstrual bleeding, and bleeding from wounds. Moreover, it helps a man from falling into vice, turns him from anger, making him happy, and it inculcates a loving and pleasant disposition in women. A valuable stone indeed ! In a slightly skewed embellishment of Albertus Magnus's comment, the claim is made that touching the stone to the eye 'drives away grievance and the blood'. In a similar way, Bartholomaeus Anglicus, the thirteenth century Franciscan encyclopaedist, claims that (Batman 1582:172), "All men knows that ….. the stone Lincurius taketh away illusions from the eyes". The late 15th century Peterborough Lapidary (Evans & Serjeantson 1933) is textually very close to the London Lapidary, and sums up the curative powers of Lygurie admirably in that it "maketh ye entrayls of a man hole". It lists Lincis under a separate entry, recommending that:

> if a man be sike in his bely, grynd this stone & drinke it with wyght wyne & he schal be hole. And yf a man haue withyne him 'la cursum' men clepeth, schal helpe him.

Help against jaundice and intestinal problems seems also to be promoted in the account of Konrad von Megenburg (1309-1374), the scholarly Canon of Ratisbon Cathedral who modeled his famous "Buch der Natur" (1350, but first published in 1475) on Thomas Cantimpré's "De naturis rerum", when he wrote (Pfeiffer 1994:48; see also Marzell 1963):

> Wenn man den stain in wazzer wescht, so hilft er den, die niht zuo stuol mugent gen, und entsleuzt den leip und widerpringt die verlorn varb an dem antlutz, wan er ist den gelsuhtigen guot und zeucht diu halmel an sich, sam der aitstain tuot.

[English translation]: The stone cleaned in water is helpful to those who suffer from costiveness, it opens the intestines, and restores the lost colour of the face. Furthermore it helps in the case of jaundice and it attracts the straws as does amber.

2.5 Renaissance literature

John Maplet (died 1592) was a Fellow of St Catharine's (1564), and subsequently Gonville and Caius College Cambridge (1566-1567), before going on to become Rector of Great Leighs in Essex and then Vicar of Northolt in Middlesex. In his popular book, "The Greene Forest" (Maplet 1567), he describes the Lyngurium thus:

> Ligurius, is a stone in colour lyke to Tin. It is engendred in the entrailes and priuities of Lynx the wilde Beast, and is of that vertue that it draweth to it any offall or chaffe or straw. It also helpeth paine in the stomack, and bewrayeth Venome or Poyson.

Note the novel application of the stone to the drawing out of poison. Stephen Batman's commentary (1582) on Bartholomaeus Anglicus' text, indicates that the stone "stancheth the flire of the wombe that is grieved".

The physician Camillus Leonardus, dedicated his "Speculum Lapidum" ("Mirror of Stones") to his master, Caesar Borgia, in 1502. In this work, translated into English in 1750, there are three references to the Lynx Stones; "Lyncurius" is effectively a repetition of information from Pliny and Damigeron, and "Ligurius" complements the medical list by including its use in ocular problems – "It appeases the Pain of the Stomach, stops the Flux of the Belly, cures the jaundice, Sharpens the Sight and by Physicians is rank'd among the Remedies for the Eyes" (Leonardus 1750:118). Here, Leonardus conflates the benefits gained from the animal as a whole with the stone it is believed to have generated; the Lynx was credited with great powers of sight, and the Accademia del Lincei was named after them (Gould 2000; Freedburg 2002). The entry for "Lincis" is the most interesting, as it includes the novel idea that it is capable of generating curative mushrooms (Leonardus 1750:116):

> Lyncis, is also a Stone generated of the Urine of the Animal of its own Name; but differs from those above mention'd; when it is in the Earth it is soft, but when put in a dry Place, it hardens. Its Colour is white mixed with black closing with one another. While it is kept in the Earth or in a Moist Place before it is made dry, it generates Mushrooms. The Virtue of this Stone, or of the Mushrooms, is to help such as are troubled with the Gravel or Stone; it takes away the Pain of the Stomack, allays the Flux of the Belly, and cures Fits of the Mother.

This idea appears to have originated with Ermolao Barbaro's (1454-1493) commentary on Pliny's "Historia Naturalis" (Barbarus 1668; Pozzi 1979; items not seen in this study). The reason for this is illuminated by the comment made by Topsell (1658:384) that:

> Hermolaus also writeth this of the Lyncurium, that it growth in a certain stone, and that it is a kind of Mushroom, or Padstoole which is cut off yearly, and that another growth in the room of it, a part of the root or foot being left in the stone, growth as hard as a flint, and thus doth the stone encrease with a natural fecundity; which admirable thing, (saith he) I could never be brought to believe, untill I did eat thereof in mine own house.
>
> Evax (as it is recited by Sylvaticus) saith that the urine of the Linx, domi servatus, generat optimos fungos supra je quotannis, reserved at home in ones house, bringeth forth every year the best Mushrooms. This is also called Lapis litzi, and Lapis prasius, which is divided into three kindes, that is, Jaspis, Armeniacus, and Lapis phrygium, called also Belemmites; wherewithal the Chirurgians of Prussia and Pomerania cure green wounds, and the Physitians break the stone in the bladder.

Note the use of Lyncurium in the treatment of gangrene. Topsell (1658:385) goes on to describe what appears to be amber, "as light as the Pumice-stone... a spungy and tenacious substance", which he takes to be Barbaro's mushrooms. In the text above, Padstoole is a toadstool, Pad being a contraction of an old English word (Paddock) for a toad. Sylvaticus is Matteo Sylvatico (died circa 1342), a physician of the Salerno school who wrote "De lapide Begaar" ("The Beggar's Lapidary"; Sylvatico 1541 – item not seen in this study) which was included in his dictionary of medical recipes, written around 1329. In respect of these mushrooms, Freedburg (2002:466) notes that "It was actually a hard-underground sclerotium, often ball-shaped, which could be collected and watered, whereupon it could produce a number of edible fungal fruit bodies over a long period". A sclerotium is a ball-shaped mass of cells used as a resting stage in the life cycles of some fungi. Freedburg (2002:466) goes on to suggest that,

amongst members of the Accademia dei Lyncei (founded in Rome in 1603), the Lyncurium was most commonly identified (e.g. Cesi 1618; Stelluti 1637) with sclerotia of the Stone Fungus, *Polyporus tuberaster*, a bracket basidiomeycete that infests the bases of certain trees.

Christopher Wirtzung (1500-1571), the physician friend of Conrad Gesner, gives several recipes incorporating Lapis Lincis as cures for bladder and kidney stones in his "General Practise of Physicke" (Wirtzung 1617):

> Item, take yellow wild Rape seed, Comin, Balsam wood, Parsley seed, sweet Cottus (?Costus?) rootes, Calmus, Annis, Asarabacca, Fennel and Cinnamon, of each one dragme, the seed of Purslaine, of Endive, of small Endive, of Lettice and Crete Marinae, of each one dragme, Lapis Lyncis, Sponge Stones, and burnt Glasse, of each one quarter of an ounce, Sugar as much as is needful for to make a Confection. One may take a dragme or two thereof with a little water; all according to the importance of the cause.
>
> There be divers powders made for this which follow hereafter: Take prepared Buckes blood half an ounce, Lapis lyncis, Lapis cancrorum, and peach kernels, of each one dragme, the seed of Parsley and Smallage, of each half an ounce, beate them all together, and temper them all together, use thereof in the morning, at noone, and in the evening half a dragme, or more at once with that kind of Beane water which immediately is described underneath, and that so long, until the stone avoid, and that you perceive no more gravel.

Oswald Croll (1560-1609) was a great proponent of the Doctrine of Signatures. This saw divine provision for man in the natural world and taught that plants and animals have hidden virtues which can be identified only by careful analysis. Croll (1669) summarises the basis of the Doctrine in the following words:

> But the foot-steps of the invisible God in the creatures, the shadow and image of the creator impressed in the creatures, or that internal force, and occult virtue of operation, (which as Natures gift is insited, and infused by the most high God, into the plant or anima, from the signature and mutual analogic sympathy and harmonious concordance of plants, with the members of the human body.

He applied this Doctrine of Signatures to the use of the Lynx Stone thus (Croll 1669:8):

> All things which expel the Stone in the humane Body, are Magically signated from the similitude, and by their resemblances signifie the Disease. The Crystal, Flint, Citrine Stone, Judaick, and Stone of the Lynx: the Urine of the Lynx coagulates into a Stone, therefore its Urine is exceeding profitable to expel Gravel in the Bladder.

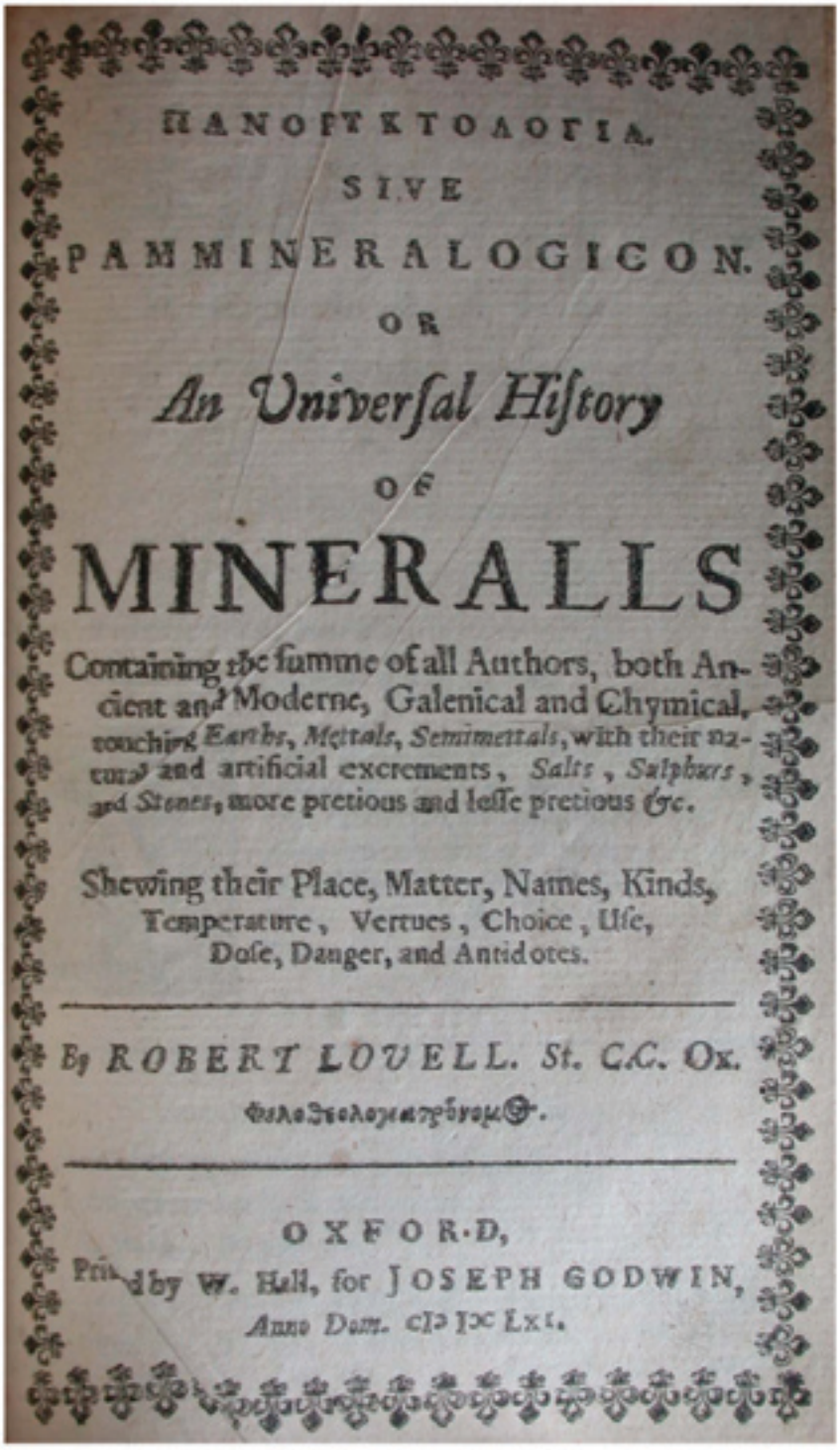
Robert Lovell (1630?-1690), a Warwickshire naturalist, studied botany, zoology and mineralogy at Oxford. Whilst there, he published several volumes drawing together insights into the classification and uses of plants and animals, culled from the works of almost two hundred and fifty authors. His "Panzoologicomineralogia" (Lovell 1661) claimed to present "a compleat history" of animals and minerals (Fig. 6). His entry for the "Lynx-stone" reiterates the advice of previous authors that it should be used in cases of urinary problems, jaundice and ‘flux of the belly', but identifies in addition that it "cureth wounds, and helpeth against the pleurisie. Some think, that being drunk it helpeth against the night mare, and fascinations, as for the smell it is unpleasant. Some say it helps travail in women".

Discussions as to the identity of Lyngurium were revitalized in the 16th and 17th centuries as apothecaries sought to include only the truest, most efficacious components in their medicines. Many authors concurred with the assertion of classical authorities that Lyncurius was but another name for amber (e.g. De Laet 1647, Mosan 1598, Topsell 1658). Anselm Boëtius de Boodt (1550-1632), physician to Rudolph II (Holy Roman Emperor and patron of the sciences), argued, however, that Lyngurium was actually a belemnite (de Boodt 1609, 1644, 1647).

2.6 Belemnites

Belemnites, of course, have a rich folklore heritage which is independent of any pharmaceutical or folk medicine use to which they might have been put (e.g. Oakley 1965; Lüschen 1979; Rätsch & Guhr 1989; Thenius & Vávra 1996; Hegele 1997).

Conrad Gesner (1516-1565)(Fig. 7), the son of a Zürich furrier, was a Swiss polymath with a



ΠΑΝΟΡΥΚΤΟΛΟΓΙΑ.

SIVE

PAMMINERALOGICON.

OR

An Universal History

OF

MINERALLS

Containing the summe of all Authors, both Ancient and Moderne, Galenical and Chymical, touching *Earths*, *Mettals*, *Semimettals*, with their natural and artificial excrements, *Salts*, *Sulphurs*, and *Stones*, more pretious and lesse pretious &c.

Shewing their Place, Matter, Names, Kinds, Temperature, Vertues, Choice, Use, Dose, Danger, and Antidotes.

By ROBERT LOVELL. St. C.C. Ox.

Φιλοθεολογιαπρόνομος.

OXFORD,

Printed by W. Hall, for JOSEPH GODWIN,

Anno Dom. cIↃ IↃC LXI.

Fig. 6: Title page of Lovell (1661).

prodigious output, publishing extensively on botany, zoology, theology, philology, medicine and geology. He died of the plague in 1565, the same year as the publication of his seminal work on fossils entitled "De Rerum Fossilium, Lapidum et Gemmarum maxime, figures et similitudinibus Liber" ("A Book on Fossil Objects, chiefly Stones and Gems, their Shapes and Appearances"). Here, for the first time, Gesner presented an illustrated systematic classification of geological materials (including fossils; Rudwick 1976). His work contains the earliest figures of belemnites (Gesner 1565a)(Fig. 8), which he placed into his 5th Class of fossils – those that resemble certain artificial things, in this case darts. Gesner indicates that belemnites were, at that time, used medicinally as Lapis Lincis against bladder stones (Gesner 1565a:89v), describing some specimens from Hildesheim.

De Boodt (1644:614) remarks on the range of colours shown by fossil belemnites – the colour of gold, iron or silver (reflecting the differences in enclosing sediment and diagenetic conditions of the specimens) – and the fact that they might be solid or hollowed out (referring to the alveolus). His argument that they represent the Lynx Stone is as follows (De Boodt 1644:615):

Fig. 7: Portrait of Conrad Gesner (1516-1565)(from Pizzetta 1894).

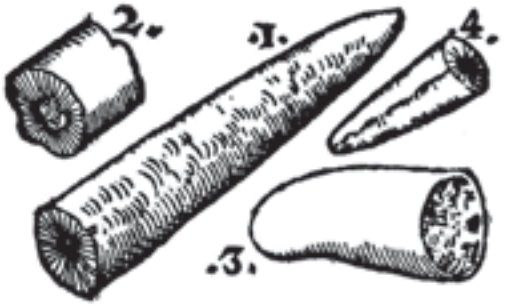


Fig. 8: Belemnites figured by Gesner (1565 leaf 91 recto), under title "Belemnitae icons hic positas, secundum numeros deinceps enarrabimus" (after Adams 1938).

> L'on appelle dans les boutiques quelques-unes de ces pierres Lyncurium. Principalement celles qui ont la couleur de l'ambre falerne, & qui sont transparentes que dans les autres. Les Allemans appellant ceste pierre alpfesscht, albschos, schostein, luchstein, rappenstein. Quand on la brusle elle a une odeur pesante, & mauuaise, comme les cornes, ou os bruslés, ou l'urine des chats: & mesme setant bruslée elle ne pose point son odeur.

He appeals to the fact that they are sold in the shops as Lyncurium, called Lynx Stones in colloquial German, and when burnt, smell like cat's urine. It is worth noting here that specimens of the Late Cretaceous zonal fossil *Belemnitella mucronata* (Schlotheim 1813) from Maastricht have a yellowish cast to their colour (Fig. 9).

Certainly, there follows a fairly consistent record of identifying belemnites with the Lynx Stone in subsequent early geological literature. For example, Thomas Nicols (1652; Fig. 10) repeats many of the comments of earlier authors, particularly De Boodt, but whilst saying that "this stone is not; as some think, the Lyncurius" (Nicols 1652:202), he includes Lapis Lincis as a synonym of belemnites in the chapter heading, and later states that "In officinis this ston is commonly taken for lapis Lyncurius" (Nicols 1652:203). He also gives an additional virtue of the stone:

> "It is reported of it that if its powder be drunk in some convenient liquor, it will prohibity lustfull dreams, and witchcrafts."

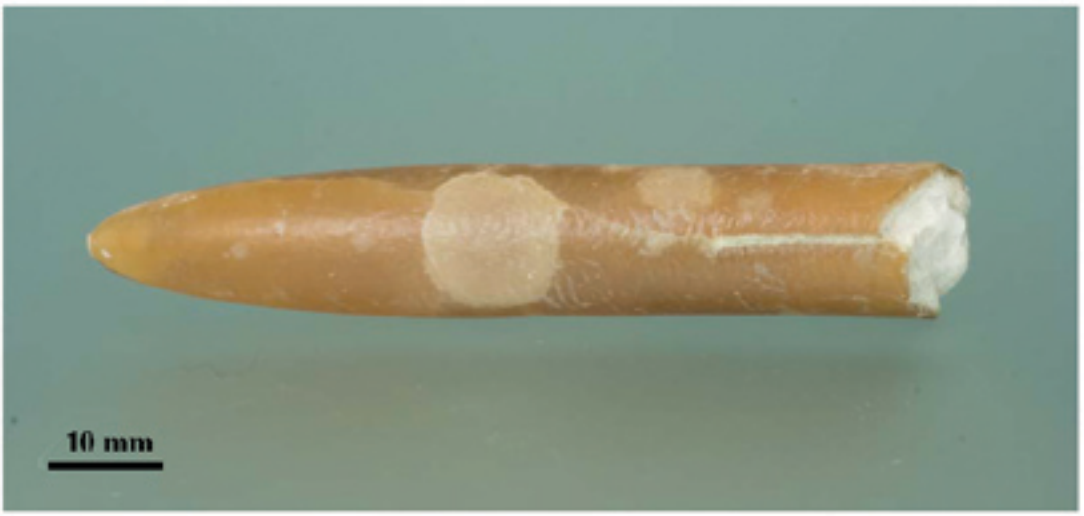
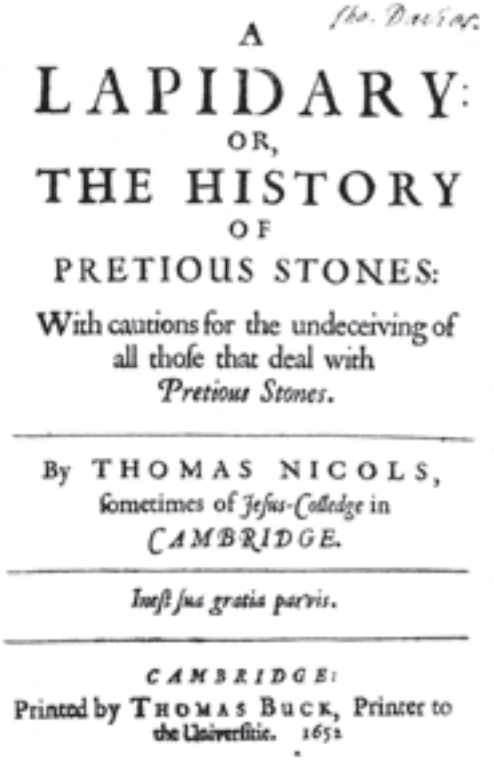


Fig. 9: Specimen of the Late Cretaceous belemnite, *Belemnitella mucronata* (Schlotheim 1813), from the Late Cretaceous of Maastricht, The Netherlands (Mnhnl. QB325).



A
LAPIDARY:
OR,
THE HISTORY
OF
PRETIOUS STONES:
With cautions for the undeceiving of all those that deal with *Pretious Stones.*

By THOMAS NICOLS,
sometimes of *Jesus-Colledge* in
CAMBRIDGE.

Inest sua gratia parvis.

CAMBRIDGE:
Printed by THOMAS BUCK, Printer to the Universitie. 1652

Fig. 10: Title page of Nicols (1652).

Robert Plot (1640-1696), Professor of Chemistry and first Keeper of the Ashmolean Museum at Oxford (Fig. 11), describes and figures a number of specimens from the Jurassic deposits around Oxford (Plot 1677, 1705; Figs. 12, 13). He cites one particular specimen (Plot 1705:95) which is:

> "hollow at the Top …. but radiated like a Star from the closer Center… draws not Straws, is somewhat transparent, and may therefore pass for a sort of Lapis Lyncurius; not that it has Original from the Urine of that Beast, for we have plentry of the Stones here, and none of the Animals, but from the unpleasant Smell it has when burn'd or bray'd; like the Urine of Cats, or such like Ramish Creatures, whereof the Lynx perhaps may be one."

Plot cites the medicinal uses of these belemnites as being for the Bladder Stone, "Exsiccation of Wounds" and "for Ocular Distempers in Horses, in all parts of England" (Plot 1705:96). The ophthalmological link here comes from the idea, persistent since classical times, that the Lynx was an animal with unrivalled powers of vision. Indeed, the Accademia dei Lyncei, the group of early 17th century Italian scientists (including Galileo Galilei) mentioned above, took their name from the beast which Plutarch said "can penetrate through trees and rocks with its sight" (Gould 2000; Freedburg 2002).

Fig. 11: Portrait of Robert Plot (1640-1696), first Keeper of the Ashmolean Museum, Oxford (from Plot 1705).

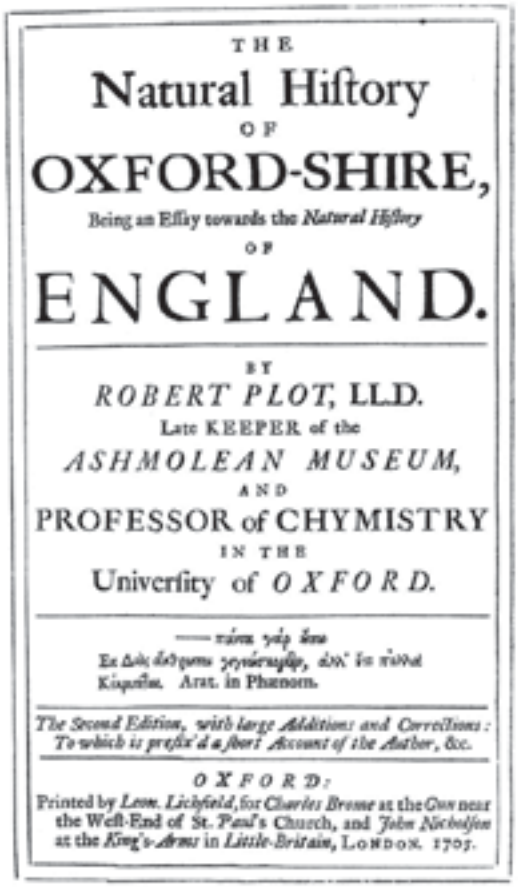
Martin (1703:134 quoted in Skeat 1912:61), with a reference to the lapides sui generis theory of fossil origins, reports of Strath and Totterness on the Isle Of Skye:

> The Velumnites [sic] grows likewise in these banks of clay, some of 'em are twelve inches long and tapering towards the end, the native call them Bat [i.e. Bot] Stones because they believe them to cure the Horses of the worms which occasion that Distemper, by giving them water to drink in which this stone has been steept for some hours.

The 'worms' referred to in the quotation above are the larvae (or 'bots') of the equine botfly (*Gasterophilus* spp.). The adult botfly lays its eggs in the coat of the horse somewhere on the forelimb, chest or head region during the May to October period. The consequent irritation to the skin causes the horse to lick and bite the infested areas, thus transferring the eggs to the mouth. This in turn stimulates the eggs to hatch and the larvae then burrow into the mucous membranes of the oral cavity. Here, they incubate for three to four weeks before migrating to the stomach, where they attach themselves to the gastric lining. Large scale stomach infestations may cause a range of symptoms including digestive upset and loss of overall condition. In extreme circumstances, perforation of the stomach wall may result in peritonitis and the death of the animal.

Bassett (1982:9) indicates that belemnites have been used to give relief from rheumatism and sore eyes in both men and horses in southern England. For the treatment of ocular problems, he notes that the fossils were crushed to a fine dust which was then blown into the eyes.

Furthermore, Michael Bernhard Valentini (1657-1729), physician to the Prince of Hessian and Professor of Medicine at Giessen University, described and figured belemnites as Lyncurium vulgaris in the catalogue of his Natur und Minerialien Kammer (Valentini 1704, 1714)(Fig. 14).



THE
Natural Hiſtory
OF
OXFORD-SHIRE,
Being an Eſſay towards the *Natural Hiſtory*
OF
ENGLAND.

BY
ROBERT PLOT, LL.D.
Late KEEPER of the
ASHMOLEAN MUSEUM,
AND
PROFESSOR of CHYMISTRY
IN THE
Univerſity of *OXFORD*.

—— τάνυ γὰρ ἔκεω
Ἐκ διὸς ἀρξώμεθ᾽, ἀτὰρ ἐν πάσαις
Κίμρεῖσιν. Arat. in Phænom.

The Second Edition, with large Additions and Corrections: To which is prefix'd a ſhort Account of the Author, &c.

OXFORD:
Printed by *Leon. Lichfield*, for *Charles Brome* at the *Gun* near the Weſt-End of St. *Paul's* Church, and *John Nicholſon* at the *King's-Arms* in *Little-Britain*, LONDON. 1705.

Fig. 12: Title Page of Plot (1705).

Fig. 13: Plate III from Plot (1705) showing several figures of belemnites which he identified with Lyncurium.

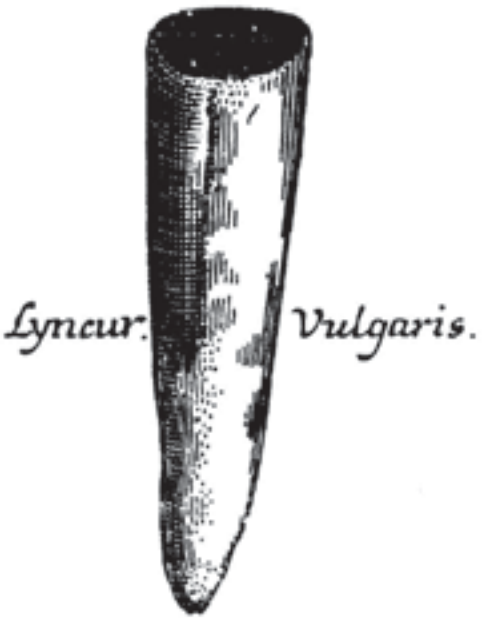


Fig. 14: Lyncurium vulgaris, a belemnite from Valentini (1704:53). Reproduced from Lüschen (1979) with the kind permission of Ott Verlag, Berne.

In a remarkable case of survival for over 250 years, some trays from the pharmaceutical collection of Sir Hans Sloane (1660-1753) are preserved in the collections of the Natural History Museum in London. Although born in Ireland, Sloane studied Medicine in London and France, eventually practicing out of the fashionable Bloomsbury Place, and even treating royalty (Queen Anne and Kings George I and II) during his long lifetime (he lived to the age of 93). He began collecting natural history specimens in 1686, and his interests broadened to, amongst other things, ethnographic and antiquarian artifacts later in life. His collection was sold for £20,000 on behalf of his two daughters, and became the nucleus of the future British Museum. The two drawers containing Sloane's pharmaceutical mineral collection (107 specimens in all) are each divided into 49 compartments, many of which have contemporary labels identifying their contents (Sweet 1935). One compartment in NHM 95739 is labelled Lapis Lincis (Fig. 15a, b), and houses a collection of numerous belemnite fragments; a second compartment, adjacent to the former in the same tray, contains spines of *Balanocidaris glandifera*, labelled as Lapis Judaicus (Sweet 1935:147; Thackray 1994:131 fig. 32; Fig. 15). Thus, in addition to the documentary evidence of Pomet (1694), Charras (1678), Culpeper (1659) and others, it is obvious from surviving contemporary pharmaceutical collections that the Lapis Lincis, generally recognized as belemnites by the apothecaries, was being used as a medicament until at least the early part of the 18th century.

Debate over the true identity of the Lynx Stone continued through the 17th and 18th centuries; the transition to our current understanding of belemnites as extinct cephalopods (Ehrhard 1727) was peppered with a variety of alternatives, briefly reviewed by Parkinson (1838). Woodward (1728), for example, considered them lapides sui generis, whilst others thought they were variously stalactites, indurated amber, plant remains, whale teeth, corals, holothurians and echinoid spines (Parkinson 1833:123), as well as fossil radishes (Hill 1751b:203).

Fig. 15: a) Drawer from the pharmaceutical cabinet of Sir Hans Sloane, dating from before 1753, reproduced by kind permission of the Trustees of the Natural History Museum, London; b) close up of adjacent compartments housing Lapis Judaicus (*Balanocidaris* spines) on the left and Lapis Lincis (belemnite guards) on the right.

Table 1: Summary of the medical applications of the Lynx Stone from classical times to the 18th century.

Name of stone	Benefit	Application	Authority
Lyngurium	None specified	None specified	Theophrastus (315 BC)
Lyngurus or Lynguro	Safety at home	Worn; Ground up in wine and drunk	Damigeron (2nd century AD)
	Keeps pregnant women and children from fear		
	King's Evil (Scrofula)		
Lincis	Joyfulness	Wear it in a ring	Damigeron (2nd century AD)
Lyncurium	Relieves jaundice	Swallowed in wine; Looked at	Pliny (circa 70 AD)
	Breaks Bladder stone	Taken in liquid	
Lyncurium	Flux of the belly	Drunk in water	Dioscorides (circa 70 AD)
	Chronic stomach ache	Drunk in wine, water or beer after a light breakfast	Hildegard von Bingen (circa 1150)
	Dysurea	Soaked in warm cow's or sheep's milk	
Lyncurium	Bad chest	Worn	Marbode of Rennes (circa 1115)
	Jaundice		
	Diarrhoea		
Licania stone	Strangury	Given as shavings	Albertus Magnus (circa 1260)
	Quartain fever (malaria)		
	Pearl in the eye (cataracts?)		
	Miscarriage and stillbirth		
Lapis lincis	Bladder stones	Powdered and mixed with herbs	13th century recipes
Ligure	Jaundice	Sucked in the mouth; Touched against the eye	London Lapidary (circa 1340)
	Takes away men's vices		
	Stomach problems		
	Gout		
	Joyfulness		
	Stops excessive menstrual bleeding		
	Stanches blood loss from wounds		
	Makes women pleasing and loving		
Lyncurius	Takes away illusions from the eyes	Not specified	BartholomaeusAnglicus (13thcentury)
Lygurie	«makes the entrayles of a man whole»		PeterboroughLapidary (14thcentury)
Ligurius	Stomach pain	Not specified	Maplet (1567)
	Draws out poison		
	Gynaecological problems	Not specified	Batman (1582)
Lincis	Sharpens the sight	Not specified	CamillusLeonardus (1502)
	General ocular problems		
	Cures «fits of the mother»		
Belemmites	Gangrene		Topsell (1658) quoting Sylvaticus
Lapis lyncurius	Prevents lustful dreams	Drunk in solution	Nicols (1652)
	Guards against witchcraft		
Lapis lyncurius	Exsiccation of wounds	Not specified	Plot (1705)
	Ocular distempers in horses		

A summary of the medicinal applications of the Lynx Stone is given in Table 1.

3. Lapis judaicus

3.1. Identity of Lapis Judaicus

There are two relatively unknown and seldom utilised applications of the term 'Lapis Judaicus'. The first is a conflation of the name with the stone identified in the legend of the Holy Grail as expressed in Mediaeval High German rhyming couplets by Wolfram von Eschenbach (circa 1170 – circa 1220) in his epic poem "Parsifal", written around 1200 to 1210 (Eschenbach 2004). Contrary to the more traditional view of the Grail as the cup from which Jesus drank at the Last Supper, the poem interprets it as being a stone dislodged from Lucifer's crown during a battle with the Archangel Michael. The stone, referred to in the poem as Lapis exilis (sometimes translated as "the stone of heaven" and whose identification with Lapis judaicus was vigorously denied by Waite 1909:401) was supposedly able to preserve a man from death, no matter how ill he might be (Spence 1920:508).

The second use of the term is for graphic granite, characterised by a texture involving the intergrowth of rod-like wedges of quartz and surrounding, usually perthitic feldspar. Graphic granites are often associated with granite pegmatites. The origins of the intergrowth texture has been the subject of much debate, but is generally thought to be due to a changing microenvironment at the junction between growing alkali feldspar host phenocrysts and the melt; local silica supersaturation along the phenocryst borders as the growing interface degrades from planar to cellular results in quartz nucleation sites, such that quartz then grows along with the feldspar (Fenn 1986). The texture, described as early as the 7th century by Isidore of Seville (Etymologiarum), gives the mineral dispositions a superficial resemblance to cuneiform, Hebrew and even Arabic characters. Often referred to as "Pierre hebraïque" in French, the association of this rock with Hebrew writing has resulted in a conflation with Lapis judaicus in some sources (e.g. Corsi 1833:219).

Fig. 16: Isolated spine of *Balanocidaris glandifera* (Goldfuss 1826) from the Kimmeridgian (Late Jurassic) of Albarracin (Teruel, Spain)(MnhnL QE151, Duffin collection).

The more usual references to Lapis Judaicus, or Jew's Stones, apply to the isolated spines of various fossil cidaroid echinoids, particularly *Balanocidaris glandifera* (Goldfuss 1826) from the Late Jurassic of Europe, North Africa and the Middle East (Fig. 16). Gesner (1565a) was, again, the first to figure them (Fig. 17a), but they also appear in catalogues of older collections (e.g. Worm 1655:69)(Fig. 17b). Their history has been considered in detail elsewhere (Duffin 2006a), so only a brief digest with additional observations will be given here.

3.2 Medical folklore

The Jew's Stone first appears in the Greek "Materia Medica" written by Pedanus Dioscorides (circa 40-90 AD) (Goodyer 1655 in Gunther 1968:655):

> But ye Judaicall stone grows in Judea, in fashion like a Glans, white, of very handsome form, having also lines answering one another as if made by turning. Being dissolved, it yields no relish in ye taste. But a Cicer-like bigness (thereof) being dissolved like a Collyrie on a whetstone with three Cyathi of warm water & drank, is of force to help Dysuries & to break ye stones in ye bladder.

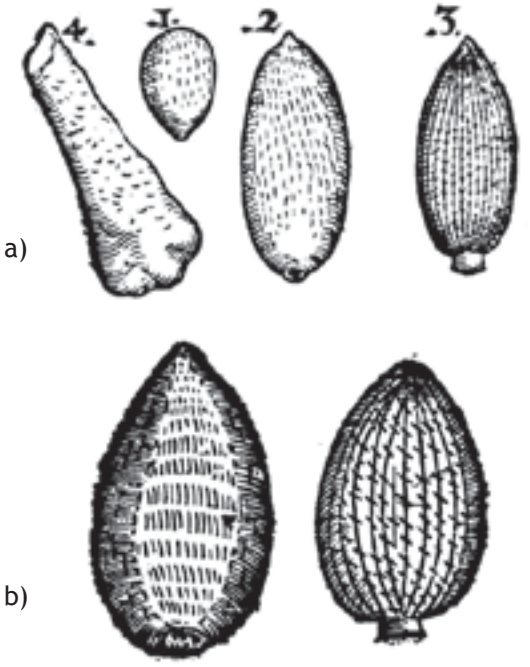


Fig. 17: Representations of Jews' stones. a, illustration from Gesner (1565). b, illustration from Worm (1655: 69).

Referring to the phallic shape of the stone, Dioscorides invokes sympathetic magic and recommends its use in cases of bladder stone, which in turn might cause dysurea – failure to void the bladder of urine. The description of the stone, and particularly the size is taken up by many subsequent authors, who commonly refer to it as the size of an olive (e.g. Grew 1681; Konrad von Megenburg 1350 [see Pfeiffer 1994]; Nicols 1659:195; Charleton 1668; Valentini 1716). This description is very helpful in identifying a synonymous stone with identical pharmaceutical properties cited by Pliny (Book 38, Cap. 68 l. 84):

> The 'tecolithos' or 'solvent stone,' looks like an olive stone and has no value as a gem, but when sucked breaks up and disperses stone in the bladder.

Note that in this case the stone is to be sucked, whilst Dioscorides recommends dissolving it in warm water. A similar versical entry is given by Marbode of Rennes (circa 1067-1081; Riddle 1977; King 1860:415):

> Of humble aspect, but of virtue rare,
> Like olive stones the Tecolites appear:
> Powdered, in water by the patients quaffed,
> The torturing stone dissolves the potent draught.

The same stone appears with identical sentiments but slightly different spellings in Konrad von Megenburg (1350; Pfeiffer 1994), Vincent de Beauvais (?1190-1264)(de Beauvais circa 1468) and the late 15th century North Midland Lapidary (Evans & Serjeantson 1933), as follows:

> Megenburg (1350): Cegolitus ist ain stain, der geleicht ainem olpaumkern. Wenn man den entlaezt in wazzer, so ist er gout zuo dem niernsttain und zuo dem stain in der platern.
>
> Vincent de Beauvais (circa 1468): Tegolithus est lapis olive nucleo similes Spernit cu videt: sed vim alion vincit bonis remedies. Solut quipped haustz pulsis calculis: renum dolorem ac velice leuat.
>
> North Midland Lapidary: Thegolite is a precious ston yt is lyke to ye rynd of an olyf tre. He is foul for to luk to, bot he is precious of

> veru, for if a man temper hym / with water it helles a man ye ston in ye reynes & in bledder.

The late 15th century Peterborough Lapidary (Evans & Serjeantson 1933) summarises its effectiveness as "he is gode to clense ye entrayles withyne forthe."

Wirtzung (1617) is, again, a rich source of information on the practical incorporation of Jews' Stones into everyday medicines. He gives at least nine different recipes to "hinder and restraine the ingendring and growing of the gravel and stone" (Wirtzung 1617:452), all involving mixing powdered stones with a variety of plant and animal parts in a measure of a suitable solvent, usually water (Duffin 2006a), and occasionally drying to produce a powder. One example is given below (Wirtzung 1617:456):

> There is also another confection prepared for this called Electuarium de Cineribus, which is a confection of ashes, as followeth hereafter: Take ashes of burnt Scorpions one quarter of an ounce, *Cantharides* without heads and wings one dragme, prepared Bucks blood one quarter of an ounce, burnt glasse, ashes of unset Coleworts, Hares ashes, ashes of Wagtayles, and ashes of Egshels whereof Chickens have bene hatched, of each two dragmes, Jew stones, stones of Ore [cow] galles, Pepper, wild yellow Rape seed, Caraway, Hollihocke seede, Gum, Saxifrage and Gromell seedes, Sefeli, Balsam fruites and the wood, India spica, Maidenhaire, Mallowes, Pompeons, Cucumbers, and Gourd seedes, of each one dragme, of Roses, as much as sufficeth for to make a confection of it, take thereof morning and evening the quantity of a hazel nut at once, tempered with the decoction of Cicers…….

Considering that this recipe is designed as a prophylactic and relief against bladder stones, it is interesting to note the inclusion of "Cantharides". This is a preparation made from the dried wing cases (elytra) of the southern European coleopteran, *Cantharides vesicatora*, commonly known as the Spanish Fly or Blister Beetle. The beetles produce a protective irritant known as cantharadin ($C_{10}H_{12}O_4$), which, in medicinal doses, is a diuretic, produces priapism (erection) in men (Felter & Lloyd 1984) and causes intense irritation of the urino-genital tract, which is apparently most effectively eased by coitus. Scholtz (1610:455) gives a similar recipe which he calls 'Electuarium lapidem comminues' (medicated paste for breaking stones).

Johann Jacob Wecker (1528-1586), a Basel physician, provides another series of recipes (Duffin 2006a) originally collected from a series of manuscripts (Wecker 1660:63), including one ascribed to Maximilian II (1527-1576) of the Habsburg dynasty, who was Holy Roman Emperor from 1564 until his death:

> For the Stone, of the Emperour Maximilian the Second. Take the best Rheubard two drams, Galanga, grains of Paradise, Anniseed, Fennelseed, Agarick, Mastick, Cinnamon, of each one dram, Licorish half an Ounce, Jews stone three drams, Mithridate five drams, Mace four drams, Cloves half a dram, *Aqua vitae* one part, Malligoe two parts. Put all these into a Glass excellent well stopt for fourteen daies; then distill them, let the Patient take a spoonful twice aweek upon an empty Stomach. *Out of a Manuscript*.

Passera (1688) recommends that Lapis Judaicus be reduced to a fine powder by grinding on a porphyry slab before being mixed with a corresponding proportion of 'Acqua d'Anonide' (Water of Yellow Restharrow - *Ononis natrix* ssp. *ramosissima*, a common Mediterranean legume), gold and saxifrage. A scruple (about 1.3g) of the mixture would supposedly smash urinary calculi.

Charras (1678:120) suggests further elements of preparation applicable to both Lapis Judaicus and Lapis Lyncis, and other stones that are "not unlike them in substance". His recommendation is:

> Having finely pouder's both the one and the other of these stones, and mix'd them with their weight of Sulphur beaten in a Mortar, make then red-hot in a Crucible over a good Charcoal-Fire, and so by degrees at several times make projection of this mixture, before you put in any more, continuing your fire till all be projected, and that the Sulphur be all consum'd; then having beaten the residence over again in a Mortar, and put it into a glass-Cucurbit, make a mixture of two parts of Vinegar distill'd, one part of good Spirit of Salt, and one other part of good Spirit of Honey well-rectify'd and pour it upon the residence swimming above it about four fingers. Then having plac'd the Cucurbit in a Sand-bath,

> and cover'd it with a Paper, kindle underneath it a good soft fire, only enough to give the substances a lukewarm heat, stirring them from time to time with a wooden Spatula, till you find that the Menstruum be sufficiently impregnated with the substance of the stone which it has dissolv'd. After which having pour'd out by inclination, and set apart the liquor that swims at the top; pour upon the residence, the like quantity of the same fresh Menstruum, placing the Cucurbit again in the same bath, keeping it there as long as the first time. Then mixing this liquor with he former, and having filter'd them, evaporate the superfluous moisture to the thin filme, if you desire a Crystalline Salt; or to the driness of the residence, if you only desire a Coagulated Salt at the bottom of the Cucurbit.

This rather complex process of distillation was seen as beneficial since it "is the drawynge forth of the thinner and purer humor out of a iuice, by the force of heate" (Gesner 1559:1). By carefully following these and similar instructions, it was possible to produce the 'quintessence' of a material, that is "the chief and the heavenliest power or vertue in any plant, metal, beast, or in the partes thereof, which by ye force and puritie of the hoale substance …. conserveth the good health of man's body, prolongeth a man's youth, differeth age, and putteth away all maner of diseases" (Gesner 1559:94). This recalls Bright's (1580:2) contention that a medicine was the resident and inherent property of the herb, fossil or stone used to cure a disease, rather than the object itself. In his words (Bright 1580:2), a medicine:

> "I define and adversarie force of some naturall thing , equally matching ye proper or next cause of ye disease. Of which medecines, Hearbes, Trees, Stones, Mineralls and metalls, Earthes, Waters and all Fruites, are matter onely, and not the very medecines them selves, for as Physicke itself is an art, and the action artificiall, and not of nature, so are the instruments of the same action artificiall, and not naturall….. so, no more is Lettis, Poppie, Rhewbarb, or Scammonie a medecine, then an Oake a Table or Ship, or a quarrie of stones a house."

The 'cucurbit' in the text (Charras 1678:120) was a gourd-like vessel which formed part of a still. The cucurbit received the condensate from a head or 'alembic' which was heated as explained. A typical arrangement is illustrated in Figs 29 and 30 and was also used to process amber (see section 5.3).

Charras (1678:120) goes on to warn the apothecary that not all of the salt collected in the cucurbit is actually the quintessence of the Jew Stone or Lynx Stone. He suggests that the sceptic might like to test the statement by dissolving the Salt and then reprecipitating it. They would find that the weight of the dried powder produced would be equal to the original material in the Menstruum (archaism for 'solvent'), to within a small margin of error.

The use of Lapis Judaicus in the treatment of urinary problems continued throughout the 17th century (e.g. Sloane Lapidary 2539 – Evans 1922:149; Imperato 1672:575; Charleton 1668). Indeed, imports of the stone into Britain were sufficiently great during Elizabethan and Caroline times to make it worthwhile levying an import tax of one shilling for every pound weight of spines (Pickering 1763:379). Sir John Hill (1759) was still prescribing the stone in the mid-eighteenth century, although by now perfectly aware of its true nature as a fossil echinoid spine (following the work of Agostino Scilla 1670, 1724; see below 3.2). He believed that its power came from the fact that it was a "sparry" (calcareous) material, and explained its modus operandi (Hill 1759:35) in that if the:

> "solid substance is given in powder, its weight carries it too fast thro' the bowels: but in the state wherein it is suspended in water, it is not liable to that objection; it passes principally by the kidneys, and as like things attract like, it brings away small stones with it."

Hill's contemporary, Robert Brookes (1763:326) had a slightly different explanation for the action of both the Jew's Stone and the Lynx Stone. In powdered form, they:

> "may unite with the salts in the fluids of a human body, and by that means render them unfit for passing through the pores of the skin; and then it is no wonder they should rush toward the kidneys, and seek for an exit that way, and afterwards be excreted in the form of large gravel."

An interesting side avenue to this story involves the lore of the Jew's Stone in the Middle East. Avicenna (980-1037) referred to Lapis Judaicus in the second volume of his monumental Persian

medical treatise, "Liber Canonis", suggesting that it be used for urinary and intestinal problems (Avicenna 1964). Moses Maimonides (1135-1204) expanded the virtues of the stone to the production of antivenin plasters, as follows (Maimonides 1211 in Muntner 1966:14):

> "To the simple remedies which draw out any poison from the organism when placed on the bitten spot, belong the following: mentastrum, Ocimum basilicum, crocodile fat of the scincus officinalis variety, pigeon excrement, duck excrement, sulphur, Ferula asafoetida (laserpitium), goat dung, green bdellium of Balsamodendron mukul, kitchen salt, all kinds of onion, lapis judaicus. Take the one at hand, crush and knead with honey in the form of a plaster to be applied to the wound after it has been sucked out by mouth or cupping glass, to draw out the remaining poison."

Although the written record of Jew's Stones in Middle Eastern medicine seems to cease with their mention in the medical compendium of Ibn Al-Baytar (1179-1248)(Ibn Al-Baytar 1874 II:5; Anataki 1935), it has recently been shown that they were used extensively throughout mediaeval Levant (Lev & Dolev 2002; Lev 2002, 2003), especially in respect of kidney stones and snake bite. Indeed, they continue to be sold as medicaments in certain markets and bazaars of Jordan, Israel and Pakistan (Lev & Amar 2000, 2002; Lev & Dolev 2002; Ali & Mhadihassan 1984).

Contemporary Jew's Stones survive in the medical drawers of Sir Hans Sloane described above (2.6; Fig. 15). In terms of provenance, spines of *Balanocidaris glandifera* sold for medicinal use in Mediaeval and Renaissance times are most likely to have come from the Mount Hermon district of what is now southern Lebanon. Mount Hermon is a ridge forming the highest ground in the Middle East (2815 m) and part of the Anti-Lebanon range along the Syria-Lebanon border. Geologically, it is a partially fault-bounded outlier of Late Jurassic rocks whose stratigraphical position has been a matter of considerable debate. Fraas (1878) identified the "Glandarien-zone", named after the echinoid spines, as being of Cenomanian age. Blanckenhorn (1890) modified the name to the "Glandarienkalk", and subsequent descriptions of coral, brachiopod and bivalve faunas established the beds as being Late Jurassic in age (Felix 1904; Krumbeck 1905; Heybroek 1942:314 – "Calcaires à Cidaris glandaria"), and perhaps Kimmeridgian. The beds are now generally accepted to be Upper Oxfordian in age (Zeev Lewy, written communication 2005). A sequence of at least 10m of hard brownish-grey, compact limestones outcrops along the southern flanks of Mount Hermon, yielding a diverse invertebrate fauna, including echinoids.

3.2 Maltese Folklore and identification as fossil echinoids

Much of the fossil lore of Malta revolves around the very strong influence of the Pauline cult. The Apostle Paul was shipwrecked on the island in 60 AD (Buhagiar 1993) on the way to face trial before Caesar in Rome (Acts 25 to Acts 28). After being caught in a 14-day long storm, the ship carrying Paul together with another 275 souls foundered on a sandbar. They made it to the beach by clinging to debris from the broken vessel. Paul then had his famous encounter with the snake in the woodpile. Whilst collecting fuel for the fire, he was bitten and (Acts 28:3-6, NIV):

> "When the islanders saw the snake hanging from his hand they said to each other, "This man must be a murderer; for though he escaped from the sea, Justice has not allowed him to live." But Paul shook the snake off into the fire and suffered no ill effects. The people expected him to swell up or suddenly fall dead, but after waiting a long time and seeing nothing unusual happen to him, they changed their minds and said he was a god."

Local embellishment of the Biblical account has it that Paul's action rid the island of all venomous snakes and other poisonous creatures. Furthermore, the fervency and erudition of his preaching converted the islanders to Christianity. Legend has it that his words were so forceful that his tongue was able to penetrate solid rock, leaving an image of itself behind. This is the account given for the abundant lamnid and *Carcharocles megalodon* shark's teeth in the Miocene deposits on the island. Just one of a series of parts of his anatomy with which Saint Paul is believed to have endowed Malta as reminders of his miracle working and life changing encounter with the islanders, there were also representations of his breasts (Mammelle di San Paolo; Zammit Maempel 1989:22; Boccone

1674:297) – actually the interambulacral plates of *Stylocidaris melitensis* Wright 1855.

Legend has it that St. Paul made his home at a cave in Rabat, now commemorated on the site by St. Paul's Grotto, Church and Museum (Zammit Maempel 1990). Pulverised rock hewn from this cavern was shaped into discs or 'medals' of "Terra Melitensis" – "Maltese Earth" – believed to be imbued with power as an antivenin. The practice of stamping the medals with various seals was a means of indicating authenticity of provenance by the Knights of Malta (Zammit Maempel 1990; Thomson 1932). The discs thus became known as "Terra sigillata" – "sealed earths". The seals themselves often portray Saint Paul holding a staff about which a snake is entwined.

On March 28th 1566, the Augustinian monk, Padre Spirito Pelo Angusciola was invited to speak following the laying of the foundation stone of Valletta. In his sermon, he referred to numerous "Vestigie di San Paolo" embedded in Maltese rocks. Amongst these, he alluded to the "Bastoncino ("stick" or "Baculum") di San Paolo" (Ciantar 1772; Zammit Maempel 1989:22) of local lore, referring to the staff mentioned above, and sported by the apostle in various illustrations and seals. Further brief mention is made by later authors, notably Boccone (1674:279), Giorgi (1730:269) and Ciantar (1772:442).

Agostino Scilla (1629-1700) appears to have developed an appreciation of the true nature of 'formed stones' as the petrified remains of once living organisms completely independently of his predecessor, Nicolas Steno (Ellenberger 1996:242). Scilla figures a representative specimen of "Hystrix spinus lapidescentes" (petrified spine of the sea hedgehog) in his seminal work, "La Vana Speculazione Disingannata dal Senso" (Scilla 1670; translated into Latin after Scilla's death as "De Corporibus Marinis Lapidescentibus"; Scilla 1724 and subsequent printings; Accordi 1978). He argues persuasively that, like other fossils from Maltese rocks, it represents the spine of a once living sea urchin, stating further that it is commonly known on Malta as "Baculi S. Pauli" (see also Parkinson 1833, volume 3: 39, pl.4 fig. 5)(Fig. 18). Scilla sums up his discussion as follows (Cochrane 1987:563):

> To conclude, all these considerations, together with the evidence given above, oblige me to believe that the shellfish, sea urchins and other echinodermata, teeth (which are called glossopetrae), vertebrae, corals, sponges, crabs, spatangina, ad turbinidae, along with many other objects that some have judged to be generated out of pure stone and tricks of nature, used to be not only animals and bodies of that species, but bodies and animals quite appropriate to the sea, which arrived by some accident within the earth with the matter they contained, and which we now see raised up in hills and mountains, either of sand and gravel or of marl, tuff, or hard stone.

The figure is of an isolated spine of the cidaroid *Stylocidaris melitensis* (Wright 1855). A similar figure and identity is given by Parkinson (1833:40, pl. 4 fig. 5). Wright originally described the species as "*Cidaris Miletensis"* [sic] from specimens supplied from "Bed no 1, the Gozo Marble" (Wright 1855:8) Malta by the Earl Ducie, and referring to an earlier manuscript description by Edward Forbes. Gregory (1891:587) later commented that it is common in the Upper Coralline Limestone, and extended its geographical range considerably. The spines of *Stylocidaris* are long (certainly over 40 mm) and slender (around 4 mm in diameter at the widest point of the spine). They are ornamented by finely denticulated longitudinal ridges. This contrasts with spines of *Cidaris avenionensis* Desmoulins, 1837, described by Gregory (1891:587) from the Globigerina Limestone of Malta, and those of *C. adamsi* Wright, 1855, in which the denticles are much coarser and thorn-like in appearance, as in Scilla (1670 pl. 24 figs II, III) (see Fig. 18).

4. Toad Stones

4.1 Origins of the Toad Stone

Like many of the fossils cited by ancient writers, the Toad Stone has a complex etymological history. The earliest reference to what may be this stone is that of Pliny ("Historia Naturalis", 37: 55, 149) who mentions the Batrachites or "Frog Stone" which originated in Coptos. The name was so given because "one variety has a colour like that of a frog, a second is similar and also has veins, while a third is red and mixed with black." Rather unusually, no medicinal or folklore information is given by Pliny for the stone.

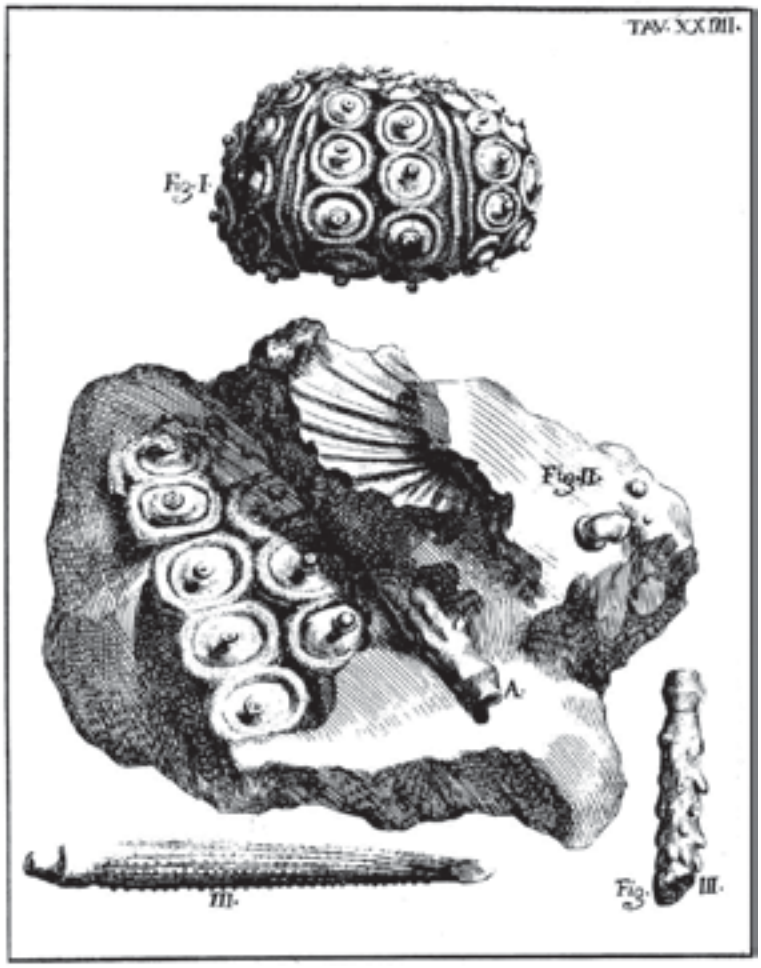


Fig. 18: Reproduction of Plate 24 from Scilla (1724); Fig. III shows a spine of *Stylocidaris melitensis*, identified by Scilla as an example of "Baculi S. Pauli" – "St Paul's stick".

The slightly later "Kyranides", a text from the second century Hellenistic school, is an alphabetically arranged compilation of magical and medical items. Believed to have been written by Harpocration of Alexandria and Kyranos, King of Persia, it was translated into Latin by Gerard of Cremona (1114-1187), the same student of Arabic who translated the works of Avicenna cited in the section above on Lapis Judaicus. One item in this treatise reads as follows (Evans 1922:19):

> "The earth toad, called saccos, whose breath is poisonous, has a stone in the marrow of its head. If you take it when the moon is waning, put it in a linen cloth for forty days, and then cut it from the cloth and take the stone, you will have a powerful amulet. Hung at the girdle, it cures dropsy and the spleen as I myself have proved."

The interesting point here is the reference to the stone in the 'marrow of its head', a theme reiterated many times in subsequent publications and even referred to by William Shakespeare in "As You Like It" (the soliloquoy of Duke Frederick in ii. I, 13), first printed in 1623:

> "The toad, ugly and venomous,
> Wears yet a precious jewel in his head."

Many stones were believed to have been engendered in the bodies of living organisms, some of which can be identified geologically, but most of which are obscure. For example, there are the Hyaenia (Hyaena Stone), Chelidonius (Swallow Stone), Chelonites (Tortoise Stone), Alectorius (Capon Stone; Duffin 2007), Saurites (from the stomach of a green lizard), Corvina (Crow Stone), Doriatides (Cat Stone), Limaceus (Snail Stone), Leucophthalmus (Wolf Stone), Quirinus (Hoopooe Stone), Vulturis (Vulture Stone), Kenne (Stag's Tears), Panteros (Panther Stone) and the Draconites (Dragon Stone).

Many of these stones were identified on the basis of their resemblance in some way to the animal concerned (such as the colouration in Pliny's batrachites), and their usefulness to man was often based upon sympathetic magic. Hence the theme which emerges so often in folklore references to frogs and toads – that of warning of, protection against or cure of poisoning. Amphibians, of course, secrete a wide range of toxins from specialized dermal parotid glands located on the back. Some of these toxins, such as those produced by Poison Arrow Frogs (*Dendrobates* spp.), have been exploited in medicine. One school of thought suggests that hallucinogenic amphibian toxins might account for the extensive use of toads in witchcraft during the Middle Ages. European toads belonging to the genus *Bufo* are known to produce a range of peptides including the poisons Bufotenine (5-hydroxydimethyltryptamine), and cardioactive steroids called bufogenins and bufodienolides (Lyttle et al. 1996; Lazarus & Attila 1993).

Returning to the Kyranides, this theme is brought out in the description of the amuletic properties of the stone (Waegemen 1987:169):

> Engrave a hawk in the frog-stone and a frog at its feet, and enclose a frog's tongue and a rootlet of the plant and the top of the tongue of the bird and give it to wear after setting. It stops every haemorrhage, and it cures those who suffer from haemorrhoids and persons with jaundice. It also works for those who vomit blood and for the women with haemorrhages of the womb. It also calms down the bad temper of enemies, especially if the hairs of the seal are enclosed underneath. The amulet also protects against venomous animals. And that stone has more divine activities about which I am yet to speak.

Alexander Neckam (1157-1215), foster brother to Richard I (Richard the Lionheart) alluded to the nature of the stone in his "De Laudibus Divinae Sapientiae" in writing (Evans 1922:62):

> This commands the toad to be of service to us,
> The stone which the 'cell' of the head nurtures
> drives away poisons.
> Because serpents are said to form this stone
> Which lays claim to great virtue.

4.2 Identity of the Toad Stone

Albertus Magnus (circa 1262) identifies two stones coming from the heads of toads, one grayish white and the other black. He states (Wyckoff 1967:76) that "If it is extracted while the toad is still alive and quivering, it has in the middle, as it were, a blue eye". This implies that, as early as the mid-thirteenth century, the objects commonly referred to as toad stones were the crushing teeth of durophagous Mesozoic fishes such as the semionotiform *Lepidotes* (Figs 19a,b), and perhaps also pycnodonts. Indeed, Mercati (1719) even figured some "Pietro di Rospo" with enclosing matrix (Fig. 20). The "little eye" here is the low cusp which occupies a central position on the crown. Many authors refer to this feature; Thomas of Cantimpré (1201-1272) feared that if the stone "be taken from a toad that has been some time dead, the poison of the creature will have already destroyed this little eye and spoiled the stone" (Kunz 1915:164). Pomet (1737:20) describes the structure of the stone in more detail:

> There are commonly two sorts, to wit, the round and the long: The round Toad stone is of the shape of a small bonnett, round Circumference, hollow below, convex above, and very smooth, about half an inch broad at the bottom, some of them are of a deep grey inclining to blue; and there are others of a reddish colour; but both sorts are usually of a much lighter colour at their bottoms. The long Toad-Stone is most frequently of an inch long, and above four or five lines thick, hollowed like a Trough on one side, and of a convex Figure on the other. Some of those are of a deeper, and some of alighter grey, marked with some reddish spots, and smooth as the round.

This conforms to the figures of toad stones given by Gesner (1565a) and Worm (1655) and repro-

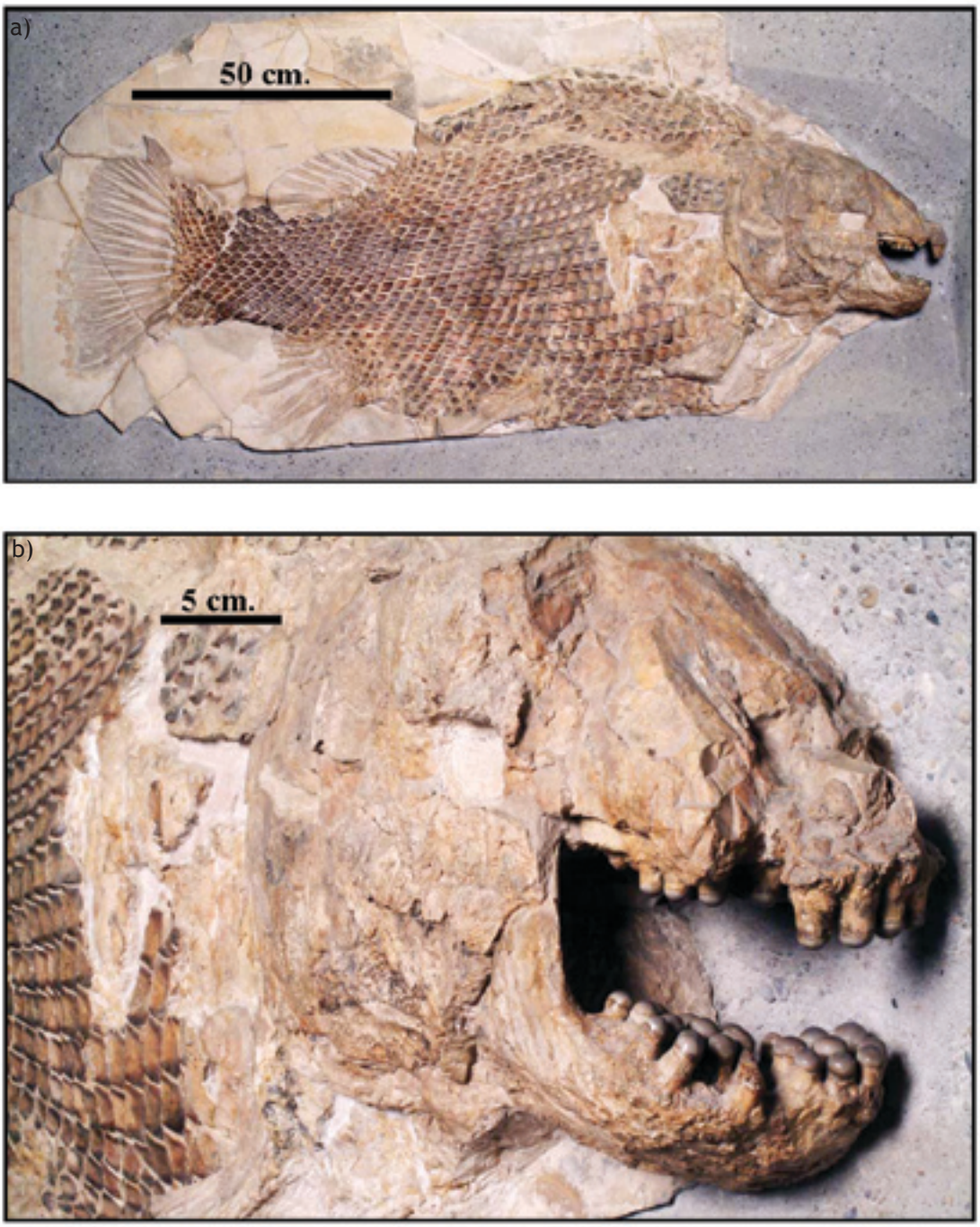


Fig. 19: *Lepidotes maximus* Wagner, 1863 (SMF P 325) from the Plattenkalk (Tithonian, Late Jurassic) of Langenaltheim, Germany (photographed by, and reproduced with the kind permission of the Forschungsinstitut Senckenberg, Frankfurt/Main). a) whole specimen in right lateral view; b) dental battery.

Fig. 20: "Pietra di Rospo" from Imperato (1672).

a)

b)

Fig. 21: Toadstones as figured a) by Gesner (1565), after Adams (1938 fig. 40); b) by Mercati (1719), after Kunz (1915:163).

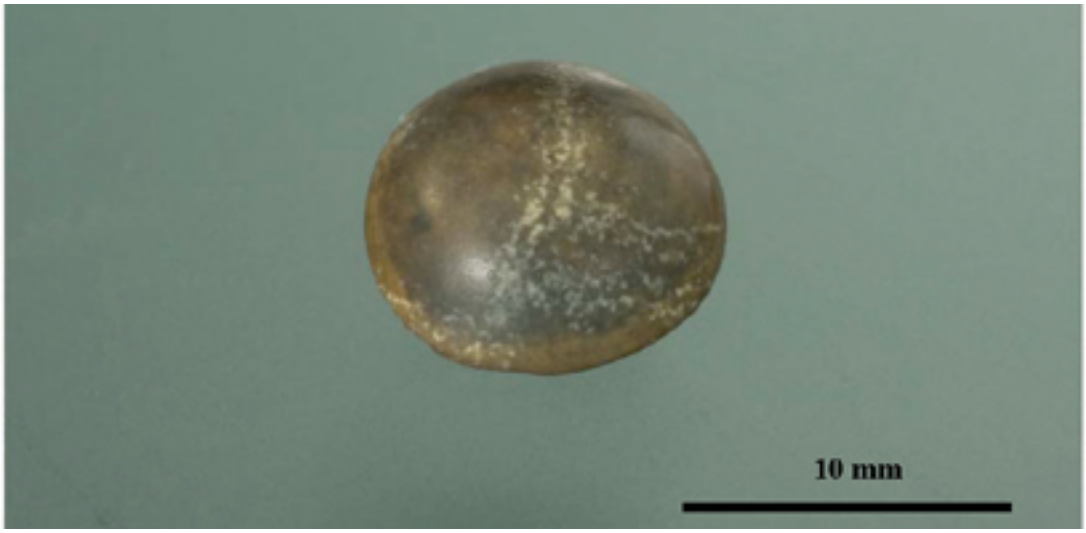


Fig. 22: Isolated tooth of *Lepidotes mantelli* (Agassiz 1833-1843) from the Cretaceous of the Peninsula de Setùbal, Lisbonne, Portugal (MnhnL QE150, Duffin collection).

duced in Figure 21. This identification has been confirmed by earlier authors (e.g. Lankester 1920). The range of colours exhibited by a single specimen can be clearly seen in Mnhnl QE150, an isolated tooth of *Lepidotes mantelli* (Agassiz 1833-1837) from the Cretaceous of Portugal (Fig. 22).

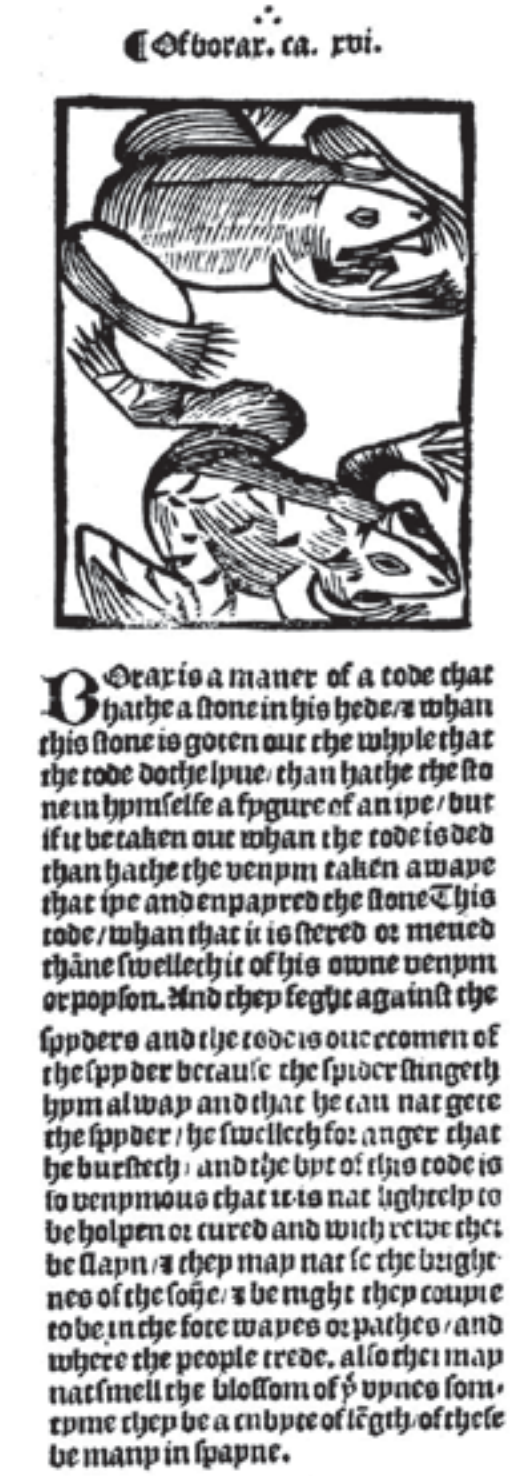
"The Noble Lyfe & Natures of Man of Bestes Serpentys Fowles and Fishes" (circa 1521; Hudson 1954) emphasises the poisonous nature of the toad and its natural antipathy to spiders. The volume indicates that, if the stone is extracted from a dead toad, the "eye" dims and all effectiveness is lost (Fig. 23).

In a separate publication, Albertus Magnus (*De Animalibus*) described the toad which supposedly yielded the stone as (Scanlan 1987:428) "a brown species of toad, very large in size and sometimes attaining a cubit in size. It lives in warm countries and at times is accustomed to carrying its offspring on its back". The description obviously refers to the Midwife Toad (*Alytes obstetricans*), an inhabitant of Western Europe, renowned for the male carrying the fertilised eggs on its back until the tadpoles emerge (Duffin 2003).

The earliest author to identify Toad Stones as being derived from fishes appears to be Scilla (1670, 1724). Palatal teeth of semionotiforms from Maltese limestones are often referred to in the literature as "Serpents' eyes" ("Occhi di Serpe"). Scilla (1724) noted the resemblance of the Maltese specimens to crushing teeth of the Atlantic Wolf Fish, *Anarhichas lupus* Linnaeus, 1758, and figured examples of the fossils next to prepared jaws of the extant fish (Scilla 1724, pl. II; Fig. 24). The Wolf Fish is the largest (up to 2m long) of the living blennies (in the perciform acanthopterygian Family Anarhichadidae), which is fished in cold, deep waters where it employs its crushing dentition as a benthonic predator of echinoderms, crustaceans and bivalves. The woodcut of Gesner (1699; Fig. 25a) illustrating the fish is somewhat stylised (it is actually a perch; compare with Fig. 25b). It is worth noting that Scilla's original material (specimens and drawing for the plates) were purchased by John Woodward (1665-1728) and are now held in the Sedgwick Museum at Cambridge University (Price 1989). One rather humorous specimen in the collection consists of two Occhi di Serpe mounted on a block which has been fashioned into the head of a snake (Fig. 26).

4.3 Procurement of the Toad Stone

Toad Stone extraction was apparently a hazardous business with success not fully guaranteed. Many authorities outline the collection of the stone from a living toad; Topsell (1658:727) describes it thus:


¶ Of borax. ca. xvi.
Borax is a maner of a tode that hathe a stone in his hede & whan this stone is goten out the whyle that the tode dothe lpue / than hathe the stone in hymselfe a fygure of an ipe / but if it be taken out whan the tode is ded than hathe the venym taken awaye that ipe and enpayred the stone This tode / whan that it is stered or meued thane swelleth it of his owne venym or popson. And they feght against the spyders and the tode is ouercomen of the spyder because the spyder stingeth hym alway and that he can nat gere the spyder / he swelleth for anger that he bursteth / and the byt of this tode is so venymous that it is nat lightely to be holpen or cured and with rewe ther be slayn / & they may nat se the brightnes of the sonne, and be night they come to be in the fore ways or pathes, and where the people trede, also they may nat smell the blossom of ye vynes somtyme they be a cubyte of length, of these be many in spayne.

> But the Art (as they term it) is in taking of it out, for they say it must be taken out of the head alive, before the Toad be dead, with a piece of cloth of the colour of red Scarlet, wherewithal they are much delighted, so that while they stretch out themselves as it were in sport upon that cloth, they cast out the stone of their head, but instantly they sup it up again, unlesse it be taken from them through some secret hole in the said cloth, whereby it falleth into a cistern or vessel of water, into the which the Toad dareth not enter, by reason of the coldnesse of the water.

This process is beautifully illustrated by a woodcut in De Cuba's (1473) "Hortus Santitatis" (Figure 27). It should be said that De Boodt (1609) tested this means of procurement of the stone when, as a boy, he sat an old toad on a red cloth as specified, and watched the creature all night. No stone was ejected, however, and "I became convinced all the tales concerning this stone were merely fond imaginings" (Kunz 1915:162).

The collection of the stone did not apparently always require the participation of a living toad. Lupton (1627) describes the following approach:

> Put a great or overgrowne Tode, (first brused in divers places) into an Earthen pot, and put the same in an Ants hillocke, and cover the same with Earth, which Toade at length the Ants will eate: So that the bones of the Toade and stone will be left in the Pot, which Mizaldus and many other (as hee saith) hath oftentimes proved.

Fig. 23: Woodcut and text entry for Borax, the Toad, in "The Noble Lyfe & Natures of Man of Bestes Serpentys Fowles and Fishes" (Hudson 1954:23). The text reads as follows: Borax is a maner of tode that hathe a stone in his hede, & whan this stone is goten out the whyie that the tode dothe love than hathe the stone in hymselfe a fygure of an iye, but if it be taken out whan the tode is ded than hathe the venym taken awaye that iye and enpayred the stone. This tode whan that is stered or meued than swelleth it of his owne venym or poyson. And they feght against the spyders and the tode is overcomen of the spyder because the spyder stingeth hym always and that he can nat gere the spyder, he swelleth for anger that he bursteth, and the byt of this tode is so venymous that it is nat lightely to be holpen or cured and with rewe ther be slayn, & they may nat se the brightnes of the sonne, and be night they come to be in the fore ways or pathes, and where the people trede, also they may nat smell the blossom of ye vynes somtyme they be a cubyte of length, of these be many in spayne.

Fig. 24: Teeth of the extant Atlantic Wolf Fish, *Anarhichas lupus* Linnaeus, 1758. reproduced from Scilla (1724, pl. II).

Fig. 25: The extant Atlantic Wolf Fish, *Anarhichas lupus* Linnaeus, 1758. a) as figured by Gesner (1699), b) line diagram drawn from a photograph of an entire fish (original).

Fig. 26: Two "Occhi di Serpe" mounted on a block fashioned into the form of a snake's head (John Woodward collection, Sedgwick Museum, Cambridge).

Fig. 27: The collection of the Toad Stone from the "Hortus Sanitatis" (1473) after Adams (1938 fig. 14).

4.4 Medicinal uses of the Toad Stone

Returning to the medical uses of the Toad Stone, Albertus Magnus (c. 1276) indicates that "if swallowed this is said to cleanse the bowels of filth and excrements" (Wyckoff 1967:76). The swallowing of a fossil fish tooth is no mean feat, but the advantage of this particular medicine is that it could be recycled and used over and over again. In the same volume, Albertus Magnus describes a second Toad Stone under the name of "Nusae", again with two varieties (Wykoff 1967:108): "One is whitish, as if milk were mingled with blood and …. the other is black, and sometimes has inside it a figure of a toad with feet outstretched before and behind". This last statement suggests either that there may have been some fanciful interpretations of the colour patterns on the teeth, or that an industry of forgery had sprung up, embellishing natural stones in order to validate their provenance and, presumably, command a higher price. Albert says further that "if both stones are shut up together in the presence of poison, they burn the hand of anyone who touches them" (Wyckoff 1967:108).

Heather (1931:223) notes that an old, pre-Reformation woman known as the Witch of Aldie:

> "had in her possession a stone, about the size of a pigeon's egg, which was obtained from the head of a toad. This stone had the miraculous power of healing all sorts of venomous bites and sores upon the human body. The surface of it, previous to being used, was as smooth as glass, but after having been put into boiling water, it became rough as a sandstone. It was then applied to the diseased part and a cure followed. It was called the "Tode's Stone".

By the late 15th century, Toad Stones were being set in rings, as the advice of the Peterborough Lapidary is that "he is god for venym, & he most be set in fine gold", while the Sloane Lapidary suggests "It is good for verchue being borne, and in encreaseth a mans goods. This stone shall sitt in silver". Nicols (1652:158) comments that:

> "Some are no bigger then the nail of the hand and these by jewellers are taken for the true Toad-stones. It is reported of it that it is good against poyson if it be worn so as it may touch the skin, and that if poyson be present it will sweate, and that if any inflations procured by venemous creatures be touched with it, it will cure them."

Certainly, numerous rings containing Toad Stones have survived to the present day (e.g. Gregorová 2006:26). For example, BM MLA. AF 1023 (Tait 1986:210, fig. 510; Kieckhefer 1990:103-4; Dalton 1912:142, pl. XV) is a beautiful fourteenth century Italian ring which bears, in addition to the Toad Stone bezel, an inscription around the hoop to increase its efficacy. At least 22 other specimens have been traced in Museum collections and will be described in a future publication (Duffin, in preparation), and some are illustrated in Figure 28. 12 unmounted specimens formed part of the Cheapside Hoard, discovered at the beginning of the twentieth century during building works in the City of London. Furthermore, the old collections of the Stuttgart Naturalien Cabinett contain a group of 9 specimens of Toad Stone, some of which have had their crowns polished and their bases cleaned and cut flat, as if being made ready for mounting in jewellery (SMNS AS 2844; Fig. 29). Indeed, Warth (1974:46) notes that Krötenstein and Batrachoides, synonyms of the Toad Stone, were recorded in Adam Ulrich Schmidlin's (1670) and a later (1700)

Fig. 28: Toadstone rings in the British Museum (Department of Mediaeval and Later Antiquities). Specimen numbers are indicated.

incomplete inventory of the cabinets of the Dukes of Württemberg, deposited in the Stuttgart collections in the 17th and 18th centuries. Many of the specimens cited above can be allocated to the large semionotiform *Lepidotes maximus* Wagner, 1863, known from complete specimens measuring up to 1.8m in length from the Tithonian (Late Jurassic) Plattenkalk of Langenaltheim (Weitzel 1930; Fig. 19). One specimen in the top right hand corner of Figure 29 is particularly interesting. While all of the other specimens have a circular outline, this particular specimen is somewhat oblate. Furthermore, although the remainder of the Toad Stones show considerable colour variation, that particular specimen is a distinctive grey and has a matt, rather than a lustrous finish. The specimen in question is a fake, carved from soapstone (steatite) so as to closely resemble true Bufonites (Böttcher and Schmidt, written communication).

The stone's reaction to the presence of poison is consistently referred to. Batman (1582:263) notes that "in presence of venimme, the stone warmeth and burneth his finger that toucheth him". Alternatively, it might change colour (Topsell 1658) or sweat (Jonstonus 1657).

It was deemed efficacious against the bites of serpents and "creeping worms" (Batman 1582:263), spiders, wasps and rats (Lupton 1627, Book 1:10), but was also useful against any poisons that might

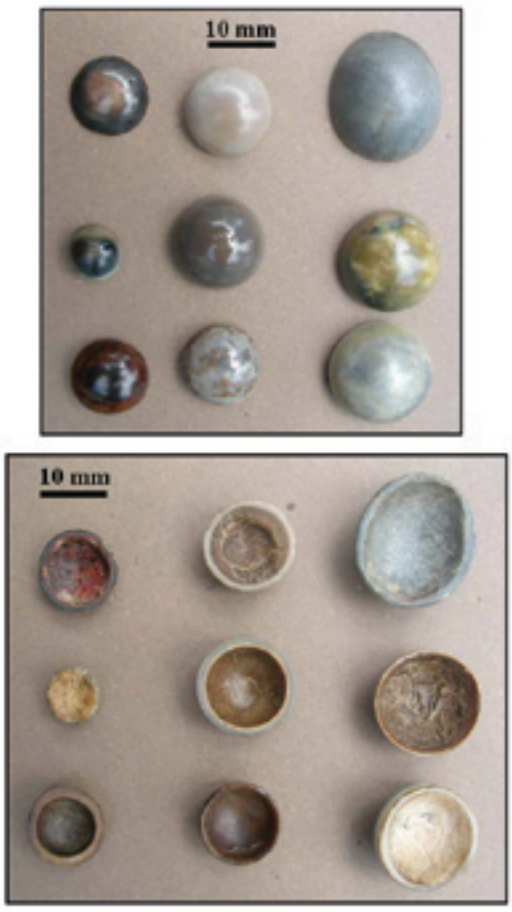


Fig. 29: Toadstone specimens in the collections of the Staatliches Museum für Naturkunde in Stuttgart (SMNS AS 2844).

be developing inside the body as a consequence of the imbalance of the humours. Taken internally, it "rolls about the Bowels, and drives out every poisonous Quality that is lodg'd in the Intestines; and then passes thro' the Fundament and is preserved" (Leonardus 1502, 1750:77). In this way, it was able to dispel the poisons associated with malignant tumours, biliousness, Erisipelas (a superficial dermal infection resulting in blockage of lymphatic vessels and caused by streptococcal and *Staphylococcus aureus* infections), apostems (deep abscesses), Bubonic Plague, carbuncles, sores (Jonstonus 1657), malaria (Quartain fevers; Lémery 1714), fevers (Leonardus 1502, 1750), Labour pains (Bacon 1628), fits, scrofula, bowel problems ("gripings and pains of the belly and small guts"; Topsell 1658:727), diarrhoea (Lémery 1714), bladder stones and epilepsy (Topsell 1658), as well as being able to protect from witchcraft against cattle, children and pregnant mothers (Jonstonus 1657; Scott 1802).

5. Amber

5.1 Origins

Amber is fossilised resin. Although a wide range of amber deposits, both in terms of geological age and geographical distribution are now known, the source of the bulk of the amber used in Europe from classical times through to the nineteenth century is the Baltic area. Eocene in age, this amber is generally agreed to have been produced by the conifer *Pinus succinifera*, although certain characteristics of the infrared spectra of the fossil resin have given rise to suggestions that araucarians and cedars might also have potentially been resin suppliers (Weitschat & Wichard 1998). Resin falling on the floor of an amber coniferous forest, which may have covered a vast area of north west Europe, was eroded and redeposited, occasionally through several sedimentary cycles, becoming incorporated into the Eocene "Blue Earth" of the Samland peninsula, Ukrainian marine glauconitic sands of Oligocene age, and Pleistocene glacial tills ranging from England in the west to Russia in the east.

The amber deposits of the Samland Peninsula in the Kaliningrad district of Russia are the largest in the world and supplied the needs of Europe for millennia. Amber has long commanded considerable awe because of its anomalous properties, intrinsic beauty and the wealth of fossil inclusions the organic gem sometimes contains (Fig. 30). It has been possible to reconstruct Roman trade routes from amber artifacts (Spekke 1976); these and later examples of worked amber have proved to be important cultural and archaeological records of the inhabitants of north-west Europe. A complex industry of amber extraction from the Blue Earth and collection of material washed onto the foreshore by storm reworking of offshore deposits took place throughout Mediaeval and Renaissance times and into the modern era (Hartmann 1677; Ley 1951). The discovery of these rich accumulations of amber spawned numerous folklore myths accounting for the origin of the stone, particularly in Lithuania and Estonia (Rice 1980). The Greeks and Romans, with whom there was a thriving trade for amber during classical times, also have a wide diversity of mythical explanations for the origins of amber, closely linked to the complex mythologies of the gods and their various dealings with mankind (Haddow 1891).

5.2 Medicinal use

Classical authors all identified amber by its distinctive hue, while noting a certain variability in colour, and its ability to attract small objects to itself when rubbed with a cloth, producing static electricity. Citation of this diagnostic character was commonly repeated by later authors. As we have seen in the discussion of Lyngurium above, the identity of particular geological materials cannot always be made with confidence from older, especially classical texts. Amber is commonly conflated with Lyngurium, but the Latin "succinum " and Greek "electron" usually clearly refer to amber when used in medicinal recipes. Dioscorides confused the sap of the black poplar with amber in his entry on "aigeiros" in reference to the Greek myth of amber's origin as the tears of the Heliades, but later authors usually made a clear distinction between the two. For further discussion on the etymological problems surrounding amber, see Riddle (1964, 1973).

Fig. 30: Specimen of Baltic Amber with an inclusion (MnhnL PAG032).

The incorporation of amber into various medicines, often mixed with a range of herbs, minerals, organic gems and 'waters' persisted right up to the nineteenth century. The earliest reference to the medicinal use of amber that I have come across is that of Pliny (Ball 1950:134, 135). He remarks (Pliny, "Historia Naturalis" 37, 11) that:

> Even today, the country women of Lombardy and those along the Po wear necklaces and collars of amber beads, mainly to adorn themselves, but in part also for their own health; for they believe that it prevents the inflammation of the tonsils and other diseases of the throat and the pharynx; for the people of that region are subject to goiter, about the fleshy parts of the throat, caused by the local water which breeds the disease. (37, XI)
>
> It is, however, true that a necklace of amber beads worn about the necks of little babies is a great protection against secret poisons and a countercharm against witchcraft and sorcery. Callistratus says that such necklaces are good for all ages, to preserve the wearer from fantastic illusions and fears that drive one out of his senses: further, amber, whether taken in drink or hung about one, cures strangury….. He says of this yellow amber that if it be worn as a collar about the neck it cures fevers and heals diseases of the mouth, throat and jaws and, powdered and mixed with honey and oil of roses, it is an excellent remedy for diseases of the ears. Compounded with the best Attic honey, it is an excellent eye salve improving dim sight; and pulverized and taken alone as a medicament, or drunk in water with mastic it is an excellent remedy for all diseases of the stomach. (37, XII)

The wearing of amber in an amuletic capacity is still done today. Hildburgh (1908:208-9) recorded the use of necklaces of amber beads in Belgian villages, particularly around Ostend as a teething aid. Similar amulets are known from Spain, where popular belief is that the amber beads, which are usually faceted, only have to be worn to be effective, and that there is no need for the child to bite on them (Hildburgh 1906:465). In Ireland, an inscribed amber bead was used as an amulet at childbirth and to cure diseases of the eye, whilst a Lowestoft fisherman carried a piece of crude amber as an anti-rheumatic charm (Ettlinger 1939:155). Gardner (1942:98) records the contemporary sale

of amber beads and necklaces in England specifically for the cure of croup, whooping-cough and asthma. Widespread belief in the Evil Eye, particularly throughout the Mediterranean area but also further afield means that the supposed apotropaic virtues of amber, outlined above by Pliny, are quite firmly entrenched in local folklore. According to Wallis Budge (1930:308), "A model of the phallus made of amber was regarded as a most powerful protection against the Evil Eye and any and every attack of evil spirits". Indeed, phallic charms of any material are still referred to as 'ambers' in certain areas of Serbia (Vukanovic 1981:43-44). A complex amulet from Toledo (Spain) containing 13 beads (a number which may ascribe greater apotropaic powers to the necklace) of agate, steatite, milky glass, jasper, and opaque amber is described by Hildburgh (1951:446). The necklace was designed to hang between the breasts in order to ease lactation.

Galen (129-200 AD) recommended working filings of amber into a lozenge with other ingredients as follows (Kühn 1965:86; Riddle 1973:7):

> Clean fleawort plant 45 drachmae, Illyrian iris, mastic, filings of amber, saffron, of separate ones, 30 drachmae, opium 15 drachmae. [Put] the beatened flea-wort plant in warm water for soaking and when this is viscous and gluey, it shall be put in water [again]. Force out to a liquid. Prepare the medicament with this. Shape this into a lozenge. Give three obols [0.7 g] when one is going to sleep.

Galen prescribed these lozenges for a range of respiratory and digestive ailments, particularly, "hemoptysis, coughing both protracted and fresh, consumption, spitting up of humors, suppuration, suffering in the bowels, dysentery, and flatulency" (Kühn 1965:86; Riddle 1973:7). The Neapolitan Lozenge, containing amber filings mixed with, once again, Spanish opium, mastic, Illyrian iris, saffron, mandragora etc., was prescribed by him for a similar range of diseases, plus rheumatism (Kühn 1965:87). He gives further prescriptions containing amber against consumption and flatulency (Kühn 1965:94) and diseases of the mouth (Kühn 1965:138; Riddle 1973:7). Galen's recipes for lozenges containing amber were later repeated by the Pergamum physician Oribasios (born circa 325 AD) and prescribed in the treatment of haemoptysis, dysentery, stomach disorders, consumption, coughing, suppuration, and running of the bladder (Riddle 1973:9).

Riddle (1973:7) notes that amber was recommended by Rufus of Ephesus, a little known contemporary of Galen, as being amongst the "approved" drugs of Aetios of Amida. Arataeus of Cappadocia (2nd century AD) lists amber tablets as being "compound medicines of tried efficacy" against the bringing up of blood in the second book of his "Therapeutics of Acute Diseases" (Adams 1856:426). He is convinced that medicines, such as the amber lozenges, which are taken internally are much more effective than external applications as they "come nearest the injured parts", working either by constricting the blood vessels ("passages of the flux"), coagulating the blood or closing the outlets (Adams 1856:424). Staunching blood flow in any of these ways was thought to be necessary because "blood is the food of all parts, the heat of all parts, and the colour of all parts" (Adams 1856:422). Similar applications were also proposed by Caelius Aurelianus (circa 430 AD) (Riddle 1973:9).

The Gallo-Roman Marcellus Empiricus compiled a medical treatise combining elements of Celtic medicine, superstition and traditional knowledge around 410 AD (Riddle 1973:9). In a rather unusual reduction of application, he recommends the lozenges described by Galen for assuaging bleeding only. For colic he suggests that "you pulverize amber and out of its powder you take two measures to be drunk in lukewarm water for three days" (Book 29, 32; Riddle 1973:9; Niedermann 1968:512). He also proposes the use of amber in a drink used to treat the "stone". Here, amber was mixed with Italian catnip, Seselis, Pepper, Saxifrage, Rock-Parsley, Cyperos and Ginger. If taken as directed, the cordial supposedly condensed the stone, allowing it to be freely voided in the urine (26, 114; Riddle 1973:9; Niedermann 1968:450; see also 26, 17 – Niedermann 1968:430). For the treatment of goitre, he recommends that "true amber" (succinum verum) be placed in a pot and heated to boiling so that it is reduced to half its volume. The residue was then burnt and the ashes used (26, 114; Riddle 1973:9; Niedermann 1968:450). "True amber" was also used in the treatment of heart palpitations by placing it in boiling water and then drinking the solution over a period of three days (21, 15; Riddle 1973:9; Niedermann 1968:377).

In terms of its medicinal value, Albertus Magnus (circa 1262) commends burning amber in order to

drive away serpents, wearing it to help maintain chastity, and using it to ease difficulties during childbirth. There is considerable overlap in this list with the mediaeval uses of jet (Gagates). The advice given by Magnus is reiterated in a medical compendium by Matteo Silvatico (1480, cap. 488), the famous doctor of the Salerno School (circa 1285-1342).

A manuscript entitled "Liber de Diversis Medicinis" ("Book of Diverse Medicines"), dating from around 1450, commends the use of amber for the "mormaile" – an inflamed sore on the leg. The recipe proceeds as follows (Ogden 1938:58):

> tak rib [ribwort plantain], germaunder, herbe yue, smalache [smallage - ?*Apium graveolens*], hayrefe, jubarbe, celidon [greater celandine] , of ilkan [each] euen a pounde, of jus of littill morell [Nightshade] halfe a pound, of yolkes and whittes of thre egges, floure of whete, schepe talghe [sheep fat] that may suffice. Sethe [boil] al togedir: ambre orientale, a peny weghte, of mastik [resin from the mastic tree – *Pistacia lentiscus*], orbane [gum-lac, a variety of lac produced by a scale insect], arnement [vitriol, a sulphate, probably of iron], ij peny weghte.

Camillus Leonardus (1502; 1750:226) notes that inhaling the fumes of burnt amber cures epilepsy, whilst "If laid on the left Breast of a Wife when she is asleep, it makes her confess all her evil Deeds". It supposedly also "fastens teeth that are loosened" and has the remarkable property of being able to identify an adulterous spouse:

> If we would discover whether a Woman has been corrupted, let it be laid in Water for three days, and then shewn to her, and if she is guilty, it will immediately force her to make water.

Following a long discussion on the origins of amber, Agricola (1546) states that (Bandy & Bandy 1955:77), in addition to being used as a replacement for incense as a fumigant for "clearing fetid or contaminated air", burnt in lamps to obtain a brighter and longer-lasting flame, cast onto funeral pyres, and used as an ingredient in ink:

> In medicine it has the property of coating and having been drunk stops bleeding no matter where it occurs. It will stop vomiting, flux of the womb, discharge from ulcers, head discharges, and cure tonsillitis and throat irritations. It strengthens the viscera and other parts of the body. Since it is sweet smelling it is good for the heart and will stop heart tremors. The fumes of white amber will drive away epilepsy. So much regarding European amber.

Raynald (1552 Boke 2, folio lxxix) takes up the theme of its beneficial use in childbirth and gynaecological problems in an English translation of Eucharius Roesslin's (1513) "Der schwangeren Frawen -und hebammen Rosen garten". He recommends putting amber on the embers of a dying fire "to sussume the nether places" because the fumes "yelde a goodly savoure, by the which the nether places open theym selfe, and drawe downewarde." In the case of excessive menstrual bleeding, he suggests tying the patient up in a carefully prescribed manner, applying a cupping glass on the untreated ventral abdominal surface, in combination with the insertion of a variety of ingredients into the vagina in order to stem blood flow, as follows (Raynald 1552, Boke 2, folio lxxix):

> Fyrst then to stynte and restrayne the outragyous fluxe of flowzes, it shall be very good to bynde the armes strayghte and strongelye, and not the feete or handes, as some unwise men do teache, and then to set a ventose, boxe, or cuppynge glasse with fyre (whyche is called boxinge) under the brestes without any scarafication: laying on also lynnen clothes dipped in vynegre on the belly between the navel and the secretes: conveyinge also into the places soche thynges which have vertue to restrayne blood: as the flower and rynde of pomegranate, amber, terra sigillata, bole armeniacke, sanguis draconis, hematites, the red rose, white frankincense, & galles: al those thinges or as many of them as ye can conveniently gette: beate them into powder in lyke portion, and temper them with red wyne, making of it a plaster, the which so tempred put into a little round bag the quantitie of a mans thombe, the which she shal put into the privie partes.

He goes on to cite the "apothecaries trochiskes", lozenges of amber which should be taken with four or five spoonfuls of Plantain Water and used to treat the same ailments. Culpeper (1651:103) advised midwives to "let her, if she please, purge her body with Pils of Amber", a recipe for which he detailed in his "Pharmacopoeia londinensis" (O'Dowd 2000:189; Culpeper 1661:161):

> Amber and Mastich of each two drachms, Aloes five drachms, Agarac a drachm and a half, long Birthwort half a drachm with Syrup of Wormwood made into a mass … it amends the evil state of a woman's body, and strengthen conception, and takes away What hinders it; it gently pugeth choler and flegm, and leaves a binding, strengthening quality behind it.

In cases of prolapse of the uterus ("the falling out of the womb"; Culpeper 1651:105), Culpeper recommends that the midwife "put it in again with a hot cloth, and there 'twil stay as long as a Cat tied to a Pudding" (Culpeper 1651:106). Somewhat extreme measures were then employed in order to ensure against further collapse – "and when you have got it up, let the woman lie with her Legs close together, and for fear she should not, tie them together with a Swathing-band; they should stop it with a Cork, and tie a Bladder over it also". Then, because "the Womb flies from all stinking things", he recommends the midwife to "let her apply stinking things to her Womb, such be Assafoetida, Oyl of Amber, the smoke of her own Hair, being burnt".

Wolveridge (1671:130) recommends oil of amber in posset-ale to "facilitate the birth, drive out the secundine, false conception or dead child", and he also prescribes powdered amber (together with Kermes berries, and red and white coral), in poached egg, to strengthen the early pregnancy and prevent miscarriage (O'Dowd 2000:189).

Bright (1586) listed amber with numerous other ingredients in a "strengthening simple" that prepares and purges "both in respect of the fancy, of the brayne, and affection of the hearte, and the complexion of both, put out of frame by the humour". The cordial comprised (Bright 1586:279):

> … borrage, buglosse, the juice of pippins and parmaines, balme, Carduus benedictus, scabions, basill seede, vincois horad, beasar stone, yuorie, pearle saphyre, iacint, corall, amber, limon and citron pile, cinnamon, cloves, wine, suffran, angellica, marygooldes, with a number of like nature, the great providence of God being such that this noble part of the hearte hath more helps and comforts peculiar thereunto then any parte of our body besides.

William Bullein (died 1576), cousin of Ann Bolleyn (the second wife of Henry VIII, executed in 1536), used amber in conjunction with a range of precious stones for the treatment of poison and a range of other diseases (see also Rice 1980:124). His recipe for "Electuarium de Gemmis" (Bullein 1562: Book 2, fol. x) consisted of white pearls, little pieces of sapphire, jacinth, cornelian, emerald and garnets, reddened coral, amber, shavings of ivory, and thin pieces of gold and silver. These were mixed with a range of herbs, including saffron, cardamom, ginger and cinnamon. In order to render the mixture into a syrup or electuary, the ingredients were then added to honey. This must have been an extremely expensive medicine to produce; it is little wonder that Bullein treated the nobility. He commends the syrup not only as a wide-ranging cure for physical diseases and states of mind, but also as an acceptable perfume (Bullein 1562, Book 2 folio x):

> This healeth cold diseases of the brayne, harte, stomake, and the Matrice, it is a medicine proved against the trembling of the harte, fayntyng and sounyng, the weakness of the stomacke, pensifenes, solitarines, kinges and noble men have used this for their comforte, it causeth them to be bolde sprited, the bodie to smell well, and ingender to the face good colour.

He also gives a recipe for "Trochisci di Ambra" (Bullein 1562: part 3, fol. xxxiiii) consisting of powdered amber mixed with powdered harts horn and coral, Gum Arabic, Tragacanth, Mastic, Gum of Laudanum, Acacia, "Hypoquistis" (possibly *Cytinus hypocistis*, a parasitic member of the Rafflesiaceae from the Mediterranean area), powdered Black Poppy, and Pomegranate flowers, all mixed together in the "slimie iuce of fleworte".

Francis Bacon, 1st Viscount St Alban (1561-1626) and famous English essayist, philosopher and statesman, recommended wearing amber beads as follows (Bacon 1824:66):

> For corroboration and confortation, take such bodies as are of astringent quality, without manifest cold. I commend bead-amber, which is full of astriction, but yet is unctuous, and not cold; and is conceived to impinguate [fatten] those that wear such beads.

Rice (1980:125) also quotes a prescription from William Salmon (1644-1713) who recommends taking powdered amber in a quarter of a pint of white wine every day for a week in order to treat

falling sickness (epilepsy). In the event that this approach was insufficient and further treatment was needed, he apparently suggested "take bits of amber, and in a colsestool put them upon a chafing dish of live charcoal, over which let the patient sit, and receive the fumes."

Nicols (1659:165ff) notes that:

> The white odoriferous Amber is esteemed the best for Physick use, and thought to be of great power and force against many diseases, as against the Vertigo and Asthmatick Paroxysmes, against Catharres, and Arthriticall pains, against diseases of the stomach, and to free it from stuffings and putrefactions, and against diseases of the heart, against plagues, venoms and contagions. The Florentine Physicians are wont to prescribe some few drops of its oyl to be taken in wine for the former purposes. It is used either in powder, or in oyl, or in Troches either in the distempers of men; or of women, either married or unmarriede, either with childe or without, or in the distempers of children.

Wecker (1660) is, again, a rich source of prescriptions which include amber as an active ingredient. The following recipes taken from his "Eighteen Books of Secrets" show that amber was used for a wide range of diseases (Wecker 1660:43, 49, 59, 65, 67, 73):

> The so much famed Countess of Kent's Pouder, good against all pestilential Diseases, French Pox, Small Pox, malignant Feavers, melancholy. The dose for a Man is twenty of thirty Grains, according to his Constitution; half the Quantity for a Child dissolved in a liile Sack warmed. Take of Magestracy of Pearls, Crabs eyes prepared, white Amber prepared, Harts-horn, Magestracy of white Corall, of lapis contra yarvum, of each a like quantity; to these add a proportionable quantity of the black tips of the great claws of Crabs; beat all these to a fine poude, and sift them through a very fine sive; to every ounce of this pouder adde a drachme of oriental Bezoar: Make all up in a ball with the jelly of Harts-horn; colour it with Saffron, adding thereto a little Musk and Ambergreece; draw them out into small Troches in the cleer ayre.
>
> Pills excellent for a weak brain, especially for old men, and such as are cold of constitution. Take the best Ambergreece and Amber, of each one dram, Lignum Aloes half a scruple, Cubebs two scruples, with the best Wine make 25 Pill, take two before supper.
>
> For pains of the Stomach, and to procure an Appetite. A spoonful of the powder of Amber must be taken in white Wine, or in broth. I had this from the most Reverend Legat Pronotary Biglia of Millan.
>
> For a weak Back. Take Amber, Nutmegs, and Corrall, of each of them alike, beat them into very fine pouder, put thereto a little grated Cinamon, and mingle them all well together, and straine the same pouder upon a fine toast of Manchet, being first sprinkled over with very good Muskadine, being toasted brown on both sides: let the Patient eat the same fasting, and use it five or six daies together, and doubtless by Gods help this will cure him.
>
> For the whites an Unguent. Take red Corall, Myrrh, bark of Frankinscence, juyce of Roses, Cyprus Nuts, leaves of wild Pomegranates, Mastick, Frankinscence, Amber, Spicknard, Galla Moschata, Coriander prepared, of each one scruple. Oyl of Roses, Mastick, Spicke Rue, of each half an Ounce, with a little Wax, make an Unguent. Roscellus.
>
> A Balsam for Wounds of the same Mans. Take pure Turpentine one pound and half, oyl of Bays, Galbanum, gum Arabick, gum Ivy, of each one ounce; Frankinsence, lignum Aloes, Galanga, Cloves, Nutmegs, middle Comfrey, Cinamon, Zedoary, Ginger, white Dittany, of each six drams, Storax liquid two ounces, Musk, Amber, of each one dram: puder what must be pudred and mingle them: add to them Aqua vitae seven pound, put them into a glazed vessel well stopt for eight days, then distil them first with a gentle fire, until the Oyl begins to drop, then increase it until you have distilled it all; then part the Oyl from the water and keep it.

Quincy (1728) concurs with Nicols as to the best type of amber to use in medicine, but indicates that it was seldom prescribed in isolation except, perhaps, in cases of Gonorrhoea. He cites it as a common ingredient of Gascoigne's Powder, a highly favoured medicine which was still being sold as late as the middle of the 19th century. The powder, usually fashioned into small balls, also contained crabs' eyes, the black tips of crabs' claws, Oriental pearls, Oriental bezoar and white coral in

roughly equal parts, all mixed together and administered in hart's horn jelly and Gum Arabic (see also Culpeper 1661:134). Finely powdered salt of amber was " given in Gonorrhea's, and in such Cases by some of great account; as also in spitting of Blood, the Bloody Flux, and an immoderate Flux of the Hamorrhoides, Menses, &c also to stop the violence of Catarrhs" (Quincy 1728:637). Quincy seems to be most impressed, however, by the use of Spirit of Amber as a "Cephalic detergent" in diseases of the nervous system. He accounts for its effectiveness in the following way (Quincy 1728:637):

> It extremely attenuates, cuts and penetrates into the most remote and minute recesses; whereby the whole nervous system is, as it were, scoured. Its chief Tendency in Secretion, and what it carries along with it, is by Urine. In the convulsive Deliriums of Fevers it is mightily Prescribed, and is reckoned not inferiour to anything in such Intentions; because, besides its peculiar Efficacy upon the Nerves, it also conduces much with Alexipharmics to promote a Diaphoresis: in all chronic Cases likewise, as Epilepsies, Palsies and the like, it is scarce ever left out of a Prescription.

Brookes (1763:94) agrees with its value in treating "cold disorders of the brain" such as "pains of the head, sleepy and convulsive diseases, as well as in hysterick and hypochondriack fits and gonorrhoeas". He recommends a dose of between "a scruple to a dram in a poached egg, or any other proper vehicle".

The use of amber for nervous disorders was still being discussed as late as the mid-nineteenth century. Gérard (1842:15) was treating "Mademoiselle V…" for a convulsive disorder from which she had been suffering for over 14 years. He found that, by getting her to wear an amber necklace weighing 70g, he was able to prevent the convulsions that were taking place throughout her body. This was effective only if she wore the necklace at the base of her neck; if he moved it to just beneath the jaw, or lay it over the collar bone, the symptoms reappeared. As soon as it was restored to the therapeutic position, her tremors ceased within a matter of 3 or 4 seconds. Enthused by his initial success, Gérard set about testing whether amber might be used successfully in the treatment of related diseases. Unfortunately, he found that there was no relief in cases of epilepsy, sciatica, or cramp. There was some improvement in a patient with extreme nervous depression, but he does comment that he prescribed opium concurrently with the wearing of the necklace. A thirteen year old girl was given a necklace to wear following a three-week long bout of chorea, but Gérard noticed no improvement in her condition after continuously wearing the necklace for 10 years. Rather reluctantly, he had to admit that Mlle V. was a startling but unique case, and conjectured that she was particularly susceptible to terrestrial electric fields, accounting for her response to the amber.

In a remarkably concise and exhaustive summary of the contemporary medicinal uses of amber in the late seventeenth century, Felice Passera (1610-1702) a Capuchin monk from the Brescia Infirmary notes that pulverised or distilled amber, mixed with wine or other alcoholic drink, was used against the plague, poisons, hydropism, worms, 'white flux of the uterus' ("flusso bianco dell'Utero"; leucorrhea, a white, yellow or green viscid vaginal discharge) and all contagious diseases (Passera 1688; Fig. 31). He also comments that it was effective against 'morbid humours of the head' which might express themselves as catarrh, epilepsy, apoplexy, dizziness, and lethargy. It was also used in cases of breathing problems, asthma, 'swelling of the stomach', all cardiac pains and illnesses, renal calculi and other urinogenital problems (when taken in 'Water of Saxifrage'), stomach ache, coughs, toothache and earache (Ragazzi 1998:13; 2000:49; 2005:70ff; Passera 1688:494ff). It accomplished all of these effects by strengthening the 'natural faculties' of the body.

In his "Pharmacopoeia Londinensis", Culpeper (1661) gives details of some interesting preparations which contain amber, in addition to those cited above for problems with birth and pregnancy. He is the only author I have come across who commends Lohoch Eclegmata or "Lick Pots". These were preparations which were thicker than syrups, but less viscous than electuaries, and were originally designed to help with respiratory problems. The mixture was taken up on the bruised end of a liquorice stick, which was then held in the mouth so that the Lohoch could melt gently from normal body heat. Culpeper (1661:131) gives details of the Lohoch portulaca or Lick-pot of Purslain:

> Take of the strained juyce of Purslain two pound. Troches of Terra Lemnia two drams.Troches of Amber, Gum Arabick, Dragons blood of each

I L
NVOVO TESORO
DEGL'ARCANI FARMACOLOGICI
Galenici, & Chimici, ò Spargirici,
CONSAGRATO
AL SERENISSIMO
MARC'ANTONIO
GIVSTINIANI
PRINCIPE DI VENETIA.
DA FRATE FELICE PASSERA
DI BERGAMO
Capuccino Infermiero della Prouincia di Breſcia.
OPERA
Molto vtile, non ſolo à Farmacologici, ma ancor'ad ogni Medico, & Profeſſore della Medicina.
DIVISA IN TRE LIBRI.
Con due Tauole, { Vna delle Offeruationi, & Diſtintioni, L'altra delle coſe più Notabili, & particolari.
1046
IN VENETIA, M.DC.LXXXVIII.
Appreſſo Giouanni Parè, all'Inſegna della Fortuna.
CON LICENZA DE' SVPERIORI, E PRIVILEGIO.

Fig. 31: Title page of Passera (1688).

> one dram. Blood-stone [haematite], The wool of a Hare tosted, of each two scruples. White Sugar one pound. Mix them together that so you may make a Lohoch of them

It was obviously very effective as Culpeper (1661:131) goes on to comment that, although it stops 'spitting of blood' and heavy menstrual bleeding, "the medicine is so terrible binding that it is better to let alone than taken", unless it is given in very small doses.

Amber was also, according to recipes given by Culpeper (1661), a common component of various 'pouders'. The Cordial Magistral Pouder, or Pulvis Cardiacus Magistralis, for example, contained white amber together with a wide range of ingredients (including Bezoar stones, Bone of a Stags heart, white and red Coral, Magisterium of Pearl, harts-horn, Ivory, Bole-armenick, Earths of Germany, Samos and Lemnos, Elks claw [hoof of the right hind foot], Tormentil roots, Wood of Aloes, Citron peels, Roots of Angelica, and Zedoary, plus gold leaf, Ambergris, and Musk). This combination of materials made it "too deer for a vulgar purse" (Culpeper 1661:135). It was esteemed to be "excellent in al Venemous diseases…. helps fluxes, corrects a stinking breath, is good for the falling-sickness, all Infirmities of the Brain and Heart … cheers a Melanchollick spirit. A scruple, half a dram or two scruples may be given in a little Borrage water, or in Sack to elderly persons not feverish".

The "Species confectionis Liberantis" was a powder containing a range of botanical simples plus emeralds, jacinth, 'granate' (garnet), white amber and, rather unusually "Raw silk tosted" (Culpeper 1661:138). Dissolved in a suitable medium, Culpeper judged it to be "a gallant cool Cordial though costly", and "exceeding good in pestilential Feavers, and preserveth from ill airs, and keepeth the humours in the body from corruption, it cools the heart and blood, strengtheneth such as are oppressed by heat".

Culpeper (1661) also mentions several electuaries which contain amber. "Philonium Persicum" "stops blood flowing from any part of the Body, the immoderate flowing of the Terms in Women, the Hemorrhoids spitting of blood, bloody fluxes, and is profitable for such women as are subject to miscarry" (Culpeper 1661:146). In addition to amber, this confection contained white Pepper, seeds of white Henbane, Opium, earth of Lemnos, blood-stone, Saffron, Castorium, Indian spicknard, Euphorbium, Pellitory of Spain, Pearls, Zedoary, Alicampane, and Camphor, all mixed together with three times their weight of Honey of Roses.

The "Queen of Colens Electuary" ("Electuarium Reginae Coloniens") was "commended as a jewel" because it supposedly "opens all obstructions and moves the Courses for which probably the good Queen might use it, as well as for Wine and Stone Colick, and to make her blithe and buxome, when she was to club with the king her husband in the great business of making Princes and Princesses." Administered in three ounces of white wine with a spoonful or two of "Syrupe of Marsh-mallows", the electuary was prepared as follows (Culpeper 1661:163):

> Take of the Seeds of Saxifrage and Gromwel, Juyce of Liquoris, of each half an ounce. Seeds of carawy, Anniseed, Smallage, Fennel, Parsly of Macedonia, Broom, Carrots, Bruscus, Sparagus, Lovage, Cummin, Juniper, Rue, Siler mountain, Seeds of Acorus, Penyroyal, Cinkfoyl, Bayberries, of each two drams. Indian spicknard, Schaenanth, Amber, Valerian, Hogs Fennel, Lapis Lyncis, of each a dram and an half. Galanga, Ginger, Turbith, of each two drams. Senna, an ounce. Goats blood prepared, half an ounce. Mix them together: first beat them into pouder, then make them into an Electuary according to Art, with three times their weight in Sugar dissolved in white Wine.

Note the inclusion of lapis lyncis in the recipe. Culpeper surmises that the eponymous Queen might be "Wife to one of those three Kings of Colen that the Legend tells us came to visit Christ in the Manger at Bethlehem".

Amber, together with Bdellium (an aromatic gum), pearls, flakes of iron, burnt coral and other items, was fashioned into pills against haemorrhoidal bleeding and ulceration, excessive menstrual bleeding and "the whites in Women" (Culpeper 1661:162). It was also incorporated into Trochisks of Winter Cherries in order to combat dropsie, dysurea and bladder stone, as well as providing a means to "prevent and cure drunkenness". An active ingredient in Trochisks of Lemnian earth, amber was combined with (Culpeper 1661:196):

> Earth of Lemnos, Bole-Armenick, Hypocistis, Gum Arabick tosted, Dragons blood, White

> Starch, Red Roses, Rose seeds, Bloodstone, Red Coral, Balaustines, Spodium, Purslain seeds a little tosted, Olibanum, Harts-horn burnt, Cypress Nuts, saffron of each two drams. Blak Poppy seeds, Gum Tragacanth, Pearls of each one dram and an half. Opium prepared one dram. With juyce of Plantane, make it into troches.

Applied externally, mixed with "Plantane Water", it was used to treat inflammation and fever. Dissolved in red wine, it was taken against the bloody flux. Rather more frighteningly, in cases of blood in the urine, the mixture was injected into the bladder, and for nosebleeds it was either dried and taken as a snuff, or mixed with oil and smeared onto the forehead. In "immoderate flow of the terms", it was injected "up the Womb", and applied directly onto wounds or haemorrhoids as a coagulant. Culpeper also added the ability of the trochisks to kill worms and "help shortness of memory arising from an over-moisture of the Brain and Nerves". In the event of plague, it was given "with borrage water two ounces and half an ounce of Treacle water".

Culpeper (1661:191) esteemed "Unguentum Comitissae" ("The Countesses Ointment") as "a galant binding Oyntment, composed neatly by a judicious brain". When applied to the abdomen it "it staies Abortion or Miscarriage in Women thought already begun; it strengthens weak backs exceedingly, and stops the immoderate flowing of the Terms and Haemorrhoids, and falling out of the Fundament and womb". Most impressed with the unguent, Culpeper comments that "for every occasion that needs binding, I would if I were eloquent, commend it in the superlative degree". The list of ingredients is impressive:

> Take of the middle bark of Acorns, Chestnuts, oaks, Beans, Berries of Mirtles, Horstail, Galls, Grape stones, Unripe services and Medlars dried, Leaves of Sloe-tree, Roots of Bistort, Tormentil, of each an iunce and an half. Bruise them grosly, and boyl them in ten pound of Plantane water til half be consumed, then take New yellow Wax eight ounces and an half, Oyl of Mirtles simple two pound and an half, Melt them and wash them nine times in the aforesaid Decoction. Being washed and melted, put in these following pouders, Middle bark of Acorns, Chestnuts, Oak, Galls, Juyce of Hypocistis, Ashes of the bone of an Ox Leg, Mirtle berries, Unripe Grape stones, Unripe services of each half an ounce. Trohes of Amber two ounces. With Oyl of Mastich so much as is sufficient, Make it into an Oyntment according to art.

Externally, Passera (1688; Ragazzi 2005:71) recommended that it be worn as a necklace or collar, or carried in some way in order to impede conditions of the head and throat. As a further treatment for throat problems, particularly inflammation and tumours, it was suggested that amber be heated in a bowl and the vapours inhaled by the patient. The carrying of an amber amulet, often on the wrist, was seen as a sensible precaution against catching the plague. It was also believed to have spiritual efficacy against every evil; when worn tied to the collar by young boys it was effective against spells and enchantments, sorceries ("maleficij") and demons, subduing all evil spiritual influences including those causing night-time fears. The golden colour of amber heralded its usefulness against fevers, and when mixed with apple and medicinal Rose Oil it was used in the treatment of diseases of the ear, much as first recorded by Pliny. Various gynaecological disorders were treated by rubbing Oil of Amber on the pudendum (Table 2e).

Although not entering in to quite the same amount of detail, a similarly exhaustive list of applications for amber is given by Lovell (1661) (see Table 2c for further details).

As late as the early nineteenth century, the fumes from burnt amber were seen as highly efficacious. Chaptal (1800:220) states that:

> The medical use of amber consists in burning it, and receiving the vapour on the diseased part. These vapours are strengthening, and remove obstructions.

He also (Chaptal 1800:220) commends a Syrup of Amber "made with the spirit of amber and opium" and which "is used to advantage as a sedative anodyne".

5.3 Amber preparations

It is clear from the quotations above that there was considerable diversity in the means of amber administration. It could be burnt so that the fumes might do their work via the respiratory system (to

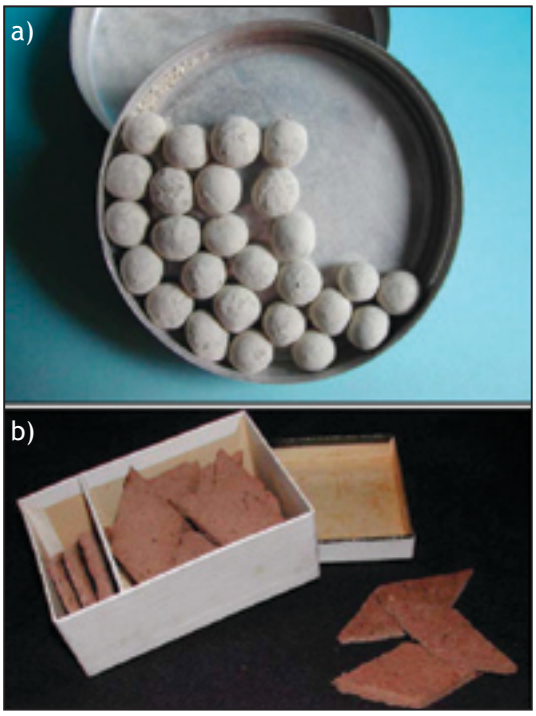


Fig. 32: Examples of amber medicines reconstructed from recipes and instructions in the "Codice Farmaceutico per lo Stato della Serenissima Repubblica di Venezia" (1790) by Professor Eugenio Ragazzi. a) "Pillole di Succino di Craton" b) "Trochisci di Karabe".

check "Violence of Rheum from the Head" – Pomet 1737:386, or 'corruption of the air' - Passera 1688, Ragazzi 2005). It could be finely comminuted on porphyry slabs and added to various other ingredients prescribed in ointments (unguents), powders, pearls, pilluli, lozenges and troches (flat, round or lozenge-shaped tablets, recommended by Pomet (1737:386) "to restrain Spitting of Blood, and to stop Dysenteries and other Lasks [diarrhoeas]"). Ragazzi (2005:21, 24, 29) has reconstructed examples of Pillole di Succino di Craton, Unguento nervino and Trochisci di Karabe from recipes and instructions in the Venetian Pharmaceutical Codex (Codice Farmaceutico per lo Stato della Serenissima Repubblica di Venezia, 1790). Some of the results of his work can be seen in Figures 32a-b. Pillole di Succino di Craton were produced from a recipe (Fig. 33a) originally formulated by Johannes Crato of Krafftheim (1519-1585; Fig. 33b) who lived and studied theology for six years with the reformer Martin Luther (1483-1546) at Wittenberg. Luther advised Crato to study medicine, which he later did at the University of Padua in Italy, eventually becoming imperial physician to Rudolph II and a plague doctor of high repute.

A variety of solvents, usually readily available (e.g. water, milk, wine, beer) or easily generated (e.g. 'Water' obtained by steeping herbs such as saxifrage or mallow, sometimes for several days) were used in order to dissolve the amber. One rather frightening solvent preparation is described by Brookes (1763:94):

> Amber will almost wholly dissolve in a strong lye, particularly one prepared with the caustick salt of the regulus of antimony, which may be had from thence; when two parts of nitre are melted with one part of the regulus of antimony in a crucible, over a strong fire; if this be mixed with an equal quantity of Amber, and water poured thereon, being boiled together, the Amber will almost wholly dissolve, and the lee which had before a burning taste, becomes more temperate. Amber thus dissolved becomes a medicine for opening the obstructions of the bowels, and promoting all sorts of excretions; and consequently is a very useful remedy in chronical diseases.

Nitre (saltpeter or potassium nitrate) is well known as a diuretic and diaphoretic, whilst the metalloid antimony (Sb, most commonly found in the mineral stibnite), a popular panacea from classical times to the early nineteenth century, is strongly emetic, cathartic and diaphoretic (McCallum 1999). Excessive doses of antimonial drugs give rise to symptoms similar to that of arsenic poisoning; little wonder that Brookes found this preparation efficient in "opening the obstructions of the bowels, and promoting all sorts of excretions" !

Thomas Fuller (1654-1734), the English cleric, physician and compiler, also recommended amber in combination with antimony, but this time for producing "Alexiterial Stones" – pills used to ward off contagions (Fuller 1710:403):

> Take Amber, red Coral each half a dram; diaphoretic Antimony, Contrayerva root, Crabseyes, each 1 dram; Crabs-claws half an ounce; levigate all upon a Marble, till it be an exquisitely fine, and impalpable Powder; which make up into little Balls, with gelly of

a)

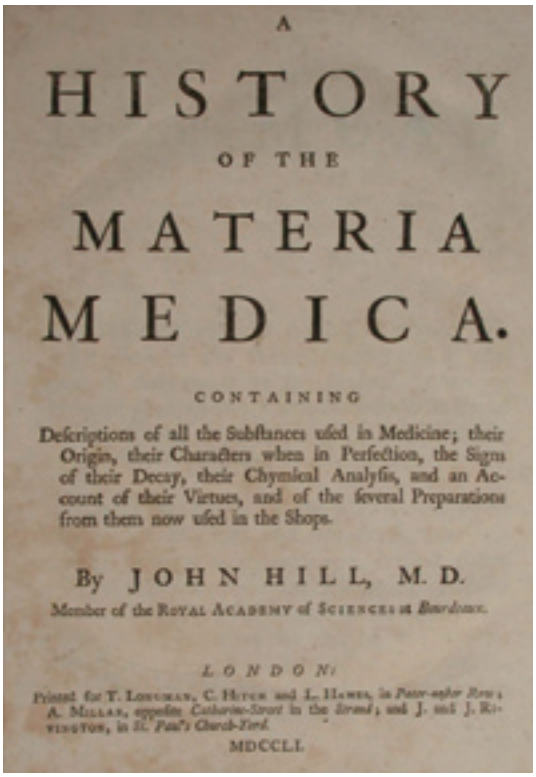
PILLOLE DI SUCCINO DI CRATON.

℞. *Succino preparato* mezz'oncia;
Polveri di Maſtice oncia una;
Agarico ottimo dramme ſei;
Radiche di Ariſtolochia dramme due;
Aloè ſoccotrino oncie due.

Coll'eſſenza di Succino ſi faccia la maſſa di pillole ſecondo l'arte.
Doſe, da grani quindici a grani trenta.

b)

Fig. 33: a) Recipe for Pillole di Succino di Craton from the "Codice Farmaceutico per lo Stato della Serenissima Repubblica di Venezia" (1790); b) Portrait of Johannes Crato of Krafftheim (1519-1585) from Crato (1583), namesake of the recipe illustrated in Fig. 33a.



A

HISTORY

OF THE

MATERIA

MEDICA.

CONTAINING

Descriptions of all the Subſtances uſed in Medicine; their Origin, their Characters when in Perfection, the Signs of their Decay, their Chymical Analyſis, and an Account of their Virtues, and of the ſeveral Preparations from them now uſed in the Shops.

By JOHN HILL, M. D.

Member of the ROYAL ACADEMY of SCIENCES at *Bordeaux*.

LONDON:

Printed for T. LONGMAN, C. HITCH and L. HAWES, in *Pater-noſter Row*; A. MILLAR, oppoſite *Catherine-Street* in the *Strand*; and J. and J. RIVINGTON, in *St. Paul's Church-Yard*.

MDCCLI.

Fig. 34: Title page of Hill (1751).

Fig. 35: Equipment for the distillation of Amber, from Mattioli (1565).

> Harts-horn; to these may be added Ambergrise 12 grains.

One further rather different application of amber is provided by Fuller (1710). He recommends that amber, together with a selection of fragrant herbal ingredients be quilted into the fabric of a night cap which was then smoked in burnt amber and other resins as follows (Fuller 1710:400):

> Take Male Piony root 2 drams; Spanish Angelica root 1 dram; Florentine Orris, Lavender flowers, each half a dram; Arabian Stechas flowers 1 dram; Cloves, Nutmeg, Mace, each 1 scruple; Storax calamite, Labdanum, Amber, Balsam of Tolu, each 1 dram; Oil of Rosemary 5 drops; reduce it to a gross Powder; which being mix'd into Cotton, is to be quilted in a silk Cap according to Art. Every Night at Bed-time, let this Cap be sumed fumed and warm'd with the smoak of Amber, Olibanum, Balsam of Tolu, or the like, Sprinkled upon Coals. Its of signal use in Humid, Pituitose Affections of the Head, in cold, customary, rheumatic Pains of the same. And its believ'd to recreate the Spirits, and roborate the Brain.

Olibanum in this recipe is a synonym of Frankincese, a resin obtained from several species of *Boswellia*, whilst Balsam of Tolu is a resin derived from the Peruvian tree, *Myroxylon balsamum*. The 'Pituitose Affections' are 'viscous humours' that accompany head colds.

Alternatively, amber could be processed in such a way as to have its 'essence' released and concentrated from the ineffectual remainder or "scurf" (Quincy 1728:637). In this way, three common amber preparations were made:

1. The Sal Succini, or Salt of Amber
2. The Oleum Succini or Oil of Amber
3. The Tinctura Succini, or Tincture of Amber.

As Hill (1751:358; Fig. 34) explains, the Salt and Oil of amber were generated together as they involved essentially the same process. A glass retort (the 'head' or 'alembic'; see section 3.1) was filled two-thirds full with lump amber, and heated to various temperatures, catching the distilled fraction in a carefully connected 'receiver' (or 'cucurbit') at each stage of the process. The equipment used in the process is illustrated in Figures 35 and 36. The progression with increasing temperature involved the production of an "acid phlegm", followed by

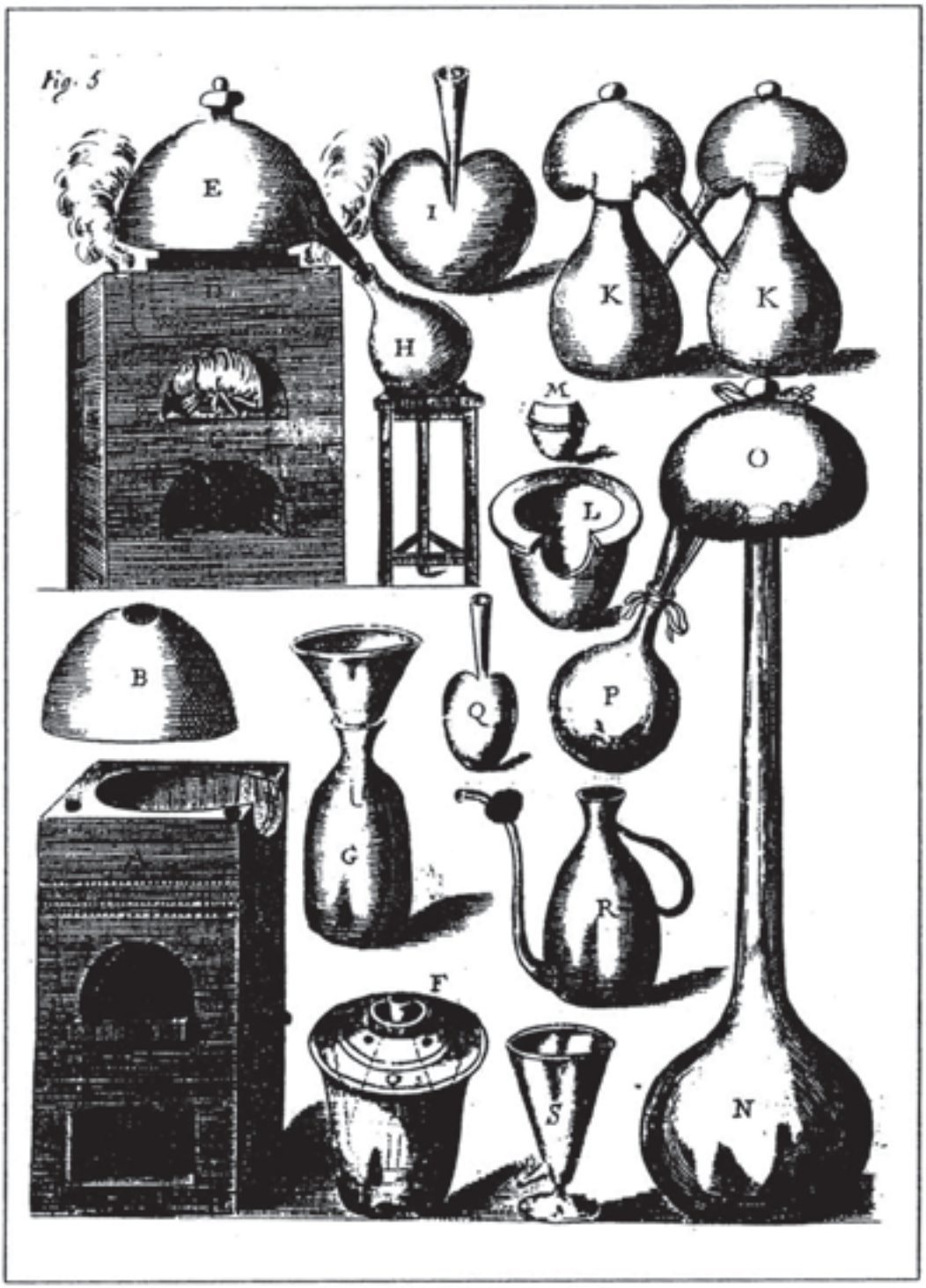


Fig. 36: Equipment used for the production of Oil of Amber and Salt of Amber, from Charras (1678).

Fig. 37: Salt of Amber crystals from Monro (1767, plate 24 figs. 23-24).

a "thin limpid oil" and finally a thicker oil. Once these had been extracted, the temperature of the fire was again increased until "the Salt will begin to show itself in white downy Efflorescences on the Inside of the Receiver, and in the Neck of the Retort". These crystals could then be carefully collected from the walls of the glassware, while the residue in the retort was heated one more time, resulting in a final volatile which sublimated as a thick black bitumen. Monro (1767, plate 24 figs 23, 24; Fig. 37) illustrated some of the 'ammoniacal' and 'neutral' Salt of Amber crystals which he obtained from a series of experiments presented to the Royal Society.

The Salt was then dissolved in water and recrystallised through a series of repetitions designed to increase its purity. Hill (1751:358) estimates its value thus (see also Brookes 1763):

> The Salt of Amber is diaphoretic and diuretic, and is esteemed a very great Medicine in Convulsions, in Head-achs, and in all nervous and hysteric Complaints. Its Dose is from five to fifteen Grains. The famous Spiritus Cornu Cervi Succinatus, is only Spirit of Hartshorn, with as much as it will dissolve of a Mixture of equal Quantities of Salt of Hartshorn and Salt of Amber.

Kunz (1915:63) recounts the story of the 16th century physician, Johann Meckenbach, who claimed to have discovered the process for producing Oil of Amber in 1548. Details of the method were available before that date, but Meckenbach communicated his 'secret' to Duke Albrecht of Prussia. When news got out, the rulers of adjacent lands pestered the Duke mercilessly for supplies of the famous medicine, which was reputed to cure a wide range of diseases. Ferdinand, Duke of Austria, sent a messenger bi-annually to Prussia in order to secure only a few flasks of the precious oil (Raumer 1835:366).

Oil of amber was purified, this time by a second distillation or "rectification". This produced a thin oil, the authentic Oil of Amber, with a thicker residue remaining in the retort – the Balsam of Amber. Oil of Amber, described by Pomet (1737:387) to be greenish and foetid, was judged to be good for the following (Hill 1751a:358):

> The Oil is a famous Antihysteric. It is also balsamic, diuretic and diaphoretic, and is an excellent Medicine in Convulsions, and in all Disorders of the Head and Nerves. Its Dose is from two Drops to ten or more, but it is a very disagreeable Medicine to take. Externally it is of great Use in the restoring contracted paralytic, weak and torpid Limbs.

The oil was estimated by Pomet (1737:386) to be "an excellent Aperitive or Deobstruent, and very good against the Scurvy, taken in any Liquor, from ten to twenty four Drops". It could also be applied to silk or cotton cloths and then rubbed on to the wrist, pulse or nose in order to "allay and drive down Vapours". Brookes (1763) commended it for "nervous disorders, particularly in the gout, palsy, and catarrhs, by annointing the parts therewith. It is given inwardly from two to twenty drops."

The greatest range of diseases for which Oil of Amber was prescribed is given by Croll (1670), who estimates that "by its own faculty it exceeds

all other Remedies in curing Apoplexy and Epilepsy" and states that "It was once called Sacred, by reason of its occult and admirable virtues". He finds it useful for "the Pest" (plague), nervous disorders, bladder stones, other urinary problems, easing birth, other obstetrical problems, fevers, cardiac problems, dental problems, catarrh, colic, vomiting blood, jaundice, vertigo, scotoma (reduced vision because of impairment to parts of the retina), and "prickings of the side". It was prescribed variously to be drunk in solution (usually water or beer), applied to the skin as a salve or ointment, and gargled. The text of his recipes is given in Appendix 1.

Mixed with honey and common salt, he recommends applying Oil of Amber to burning ulcers, with the additional benefit that "also it draws out little Bones from Wounds, Splinters, or small parts of Lint, by the imprudence of the Chyrurgeon too deeply illapsed."

Fuller (1710) commends using Oil of Amber mixed with "Populeon ointment" (made from the buds of the Black Poplar, *Populus nigra*) in order to make "hemorrhoidal Unguent", which was to be directly applied when the haemorrhoids are "swell'd and painful" (Fuller 1710:423).

As late as the late nineteenth century, Oil of Amber was commended for certain types of gout and rheumatism, the relief of pain and inflammation in the joints, and as an antispasmodic in the treatment of asthma, whooping-cough (pertussis), and bronchitis (Kunz 1915:64), as well as being used as an emmenagogue (encouraging blood flow to the pelvic region in order to counteract amenorrhea and hysteria, or disturbances of the uterus; Pereira 1842:426). Oil of amber was also described as a rubefacient, since it causes the skin to redden by vasodilation. Duncan (1806:567) comments that "it is chiefly celebrated in hysterical disorders, and in deficiencies of the uterine purgations" and may be used "in liniments for weak or paralytic limbs and rheumatic pains" (see also Murray 1810:154). Parrish (1827:54; see also Condie 1853:212) recommends applying an enema consisting of an emulsion of rectified oil of amber, gum Arabic, loaf sugar and cinnamon water, together with a few drops of laudanum in cases of infantile convulsions accompanying intestinal spasm. The treatment was given every two hours or "according to circumstances", and might be combined with the use of a linament rubbed along the spine. The embrocation consisted of a teaspoonful each of oil of amber and laudanum, together with a tablespoonful each of olive oil and brandy (Parrish 1827:55; Condie 1853:212).

Tinctures were alcoholic extracts or solutions of non-volatile substances, including amber. Hill (1751a) explains its preparation as follows:

> Take fine laevigated Amber, grind it in a glass Mortar a long Time with as much Oil of Tartar per Deliquum, as will make it a thin Paste; dry this Paste over a gentle Heat, and then powder it, and expose it to the Air to run and moisten again; repeat this three or four Times; at last dry it thoroughly. Rub it to a fine Powder, and put it into a tall Glass with as much Spirit of Wine rectify'd as will cover it three Fingers deep. Shake the whole well together, and set the Vessel in a Sand Furnace, giving such a Degree of Heat as will just make the Spirit simmer, for two or three Hours. Let it stand till perfectly settled, then pour it from the Faeces, and filter it for Use. It will be a bright red tincture. …. Its Dose is from thirty to forty or fifty Drops.

Pomet (1737:386) indicates the uses of Tincture of Amber thus:

> Also from powder of Amber, with Spirit of Wine [wine distilled to yield alcohol], is drawn a Yellow Tincture, endow'd with a great many good Qualities, especially in apoplectick and epileptical fits, and paralytick cases, taken from ten drops to a Dram in any agreeable Liquor: some dissolve pure fine Camphire in this Tincture to make what Monsieur SoLleysel calls the Flaming Balsam, and recommends for wounds, bruises, or cold Humours in Horse or Man.

Fuller (1710:413) recommends the use of amber in an Epileptic Tincture:

> Take Russia Castor half an ounce; yellow Amber powdered, English Saffron of each two drams; fresh Flowers of Lily of the Valley one ounce; to these pout Salt Volatile Sudorifick (before described) ten ounces, digest without heat 6 days, and then decant and filtre. It thoroughly and miraculously (saith the Communicator) eradicates an Epilepsy and Hysteric Passion; if given before and after the Paroxysme, and repeated before New and Full Moons. The Dose is from one scruple to one dram, in Black-cherry or Lime-flower-water, or a Cephalic Julep.

Toward the end of the eighteenth century, Cook (1770:20) notes also that "Applied to wounds, and ulcers of all sorts, it excellently deterges or cleanses them when foul, and heals them." He remarks that since " Several have justly recommended Amber as a great preservative of health, and long life", he therefore intended to embark on a course of the fossil resin, adding the wise comment that "surely, when once a physician takes his own medicine, the patient need never be afraid to follow the example."

A list of further brief recipes for tinctures, essence, juleps, balsams, liquors, troches, pilluli and fumigants using amber as a base are given by Russo (1997:194-195).

With expanding interests abroad, especially in newly explored and colonised equatorial and tropical countries, visiting or ex-patriot Europeans required some means of treatment for bites from venomous snakes. The market quickly became awash with competing proprietary products, but Eau de Luce was amongst the most popular. On January 20th 1759, Samuel Johnson (1709-1784), the famous English writer, lexicographer and critic commented in passing in an article for his magazine, *The Idler*, on the debate then raging over the efficacy of the preparation. Still employed in mid-Victorian times, Eau de Luce was succinated ammonia. Chaptal (1800:220) commended his own recipe thus: "To make eau de luce, I dissolve Punic wax in alcohol, with a small quantity of oil of amber; and on this I pour the pure volatile alkali." Eau de Luce was both applied directly to the wound and taken as a drink, usually in combination with a wide range of other treatments. De Manoncour (1776:475) was fully convinced of the power of Eau de Luce to bring about full recovery in snake bite victims, but Home (1810:217) was in considerable doubt as a result of his studies of people bitten by rattlesnakes, writing: "There does not appear to be any foundation for such an opinion ; for, when the poison is so intense as to give a sufficient shock to the constitution, death immediately takes pIace". Murray et al. (1832:94) give some further interesting case histories where Eau de Luce was administered, but with rather happier conclusions for the victims, in spite of the fact that ammonium carbonate and pure nitric acid were applied to the wound of one woman bitten by a water snake.

Buchan (1790:464) commends the use of amber vapour as an inhalant "when the nose abounds with moisture". He goes on to suggest the use of a "snuff made of the leaves of marjoram, mixed with the oil of amber, marjoram and aniseed" for "moistening the mucus when it is too dry". In the event that the "nerves which supply the organs of smelling are inert", he suggests anointing the forehead with balsam of Peru mixed with a little oil of amber. The former simple is the resin of the leguminous Peru Balsam or Tolu tree (*Myroxylon balsamum*), which is still used today on account of its well established antiseptic properties.

The popularity of amber and its derivatives as ingredients for simples in the apothecarial community led to a brisk trade in the commodity, which could be shipped easily from place to place either as lump amber, powder, or fully prepared oils, balsams, tinctures etc. The high demand and esteem of the material naturally provided an opportunity for taxation. The import duty on one pound weight of "Oyle of amber" in 1660, during the reign of Charles II of England, was ten shillings (Pickering 1763:380), "to be paid according to the tenor of the act [of the Rates of Merchandize] of tonnage and poundage, from the 24th day of June inclusively, in the twelfth year of His Majesty's reign, during His Majesty's life, and subscribed with the hand of Sir Harebotle Grimston, baronet speaker of the house" (Pickering 1763:368).

It is worth noting that even today amber is promoted commercially as a drug. Ambrex is the registered trade name of a Siddha medicine (Ragazzi 2005:39). Siddha is one of the two main systems of Indian medicine (the other being Ayurvedha) originating in the south of the country. Ambrex utilises amber mixed with a variety of herbs, particularly leaves, seeds and roots of *Withania somnifera* (the Ashwagandha, a solanacaean shrub), male cones of *Cycas circinalis* (the Queen Sago), the resin of *Shorea robusta* (the Sal Tree, a magnoliophyte) and the root of *Orchis mascula* (the Salep Orchid). Supplied by Cure and Care Herbs Ltd in Anna Salai, Chennai, India, the 250mg capsules contain 15% amber. Ambrex is recommended by the manufacturers as an envigorant and is being investigated for its antioxidant properties, particularly in the potential treatment of gastrointestinal ulcers (Jainu & Shyamala Devi 2004; Narayan et al. 2004; Devi et al. 2003).

A variety of amber medicinal products is still available in the Baltic region. An internet search will, for example, yield results for amber ointment (an analgesic for rheumatoid arthritis, neuralgia and muscle pain), amber tincture (applied externally for headaches and migraine, and taken internally for thyroid, gall bladder, renal, cardiac and kidney problems) and amber oil (for scalds, skin allergies, insect bites and stings, rheumatic and muscle pain) from Polish suppliers. From Lithuania it is possible to purchase pillows filled with amber (exploiting its high thermal conductivity and recalling the quilted caps of Fuller 1710), amber incense and amber cosmetic powder.

The uses of amber in medicine are summarised in Tables 2 a-e.

Table 2a: Summary of the medical applications of amber from the 1st to the 5th century.

Benefit	Application	Authority
Diseases of the throat; goitre	Worn about the neck	Pliny circa 70 AD
Protection against poison		
Countercharm against witchcraft and sorcery		
Counteracts irrational fears		
Strangury		
Fevers		
Diseases of the ears	Mixed with honey and oil of roses	
Poor vision	Salve	
Stomach disorders	Drunk in water	
Haemoptysis (coughing of blood)	Lozenges	Galen (129-200 AD)
Coughing		
Consumption		
Spitting up of humors		
Suppuration		
Bowel diseases; dysentery, flatulence		
Bringing up blood	Tablets	Aretaeus of Cappadocia (2nd century AD)
Dysentery	Lozenges	Oribasios (after 325 AD)
Haemoptysis (coughing of blood)		
Consumption		
Coughing		
Running of the bladder		
Bowel diseases		
All pestilential Diseases, French Pox, Small Pox, malignant Feavers, melancholy		
Bladder stones	Drunk with water	Marcellus Empiricus (circa 410 AD)
Goitre	Mixed with herbs and drunk with water	
Heart Palpitations	Ashes	
Bleeding	Drunk with water	

Table 2b: Summary of the medical applications of amber in the 16th and early 17th centuries.

Benefit	Application	Authority
Fastens loose teeth	Burnt as a fumigant	Camillus Leonardus (1502)
Identifies an adulteress	Not specified	
Causes a wife to confess evil deeds	Steeped in water and then presented to wife	
Stops bleeding, including menstrual	Laid on the left breast whilst she sleeps	
Vomiting	Drunk	Georgius Agricola (1546)
Stops discharges from ulcers and the head		
Cures tonsillitis and throat problems		
Strengthens the viscera		
Prevents heart tremors		
Epilepsy		
Eases childbirth	Inhaling fumes	
Gynaecological problems	Powdered with herbs and inserted into the vagina; taken as lozenges	Thomas Raynald (1552)
General strengthening of body, particularly the brain and heart		
Epilepsy	Mixed with other precious stones	William Bullein (died 1576)
Vertigo	Powdered with herbs and drunk in a cordial	Bright (1586)
Asthma	Oil of Amber taken in wine	Nicols (1659)
Catarrh		
Arthritis		
Stomach disorders		
Heart disease		
Plague		
Venoms		
Contagions		
Distempers		
Gonorrhoea	Troches (tablets)	
Weak brain	Tablets	John Wecker (1660)
Stomach pains	Pills	
Loss of appetite	Drunk in wine or broth	
Weak back		
The «Whites»	On toast	
Wounds	Unguent (salve or ointment)	
Poison	Balsam (aromatic ointment)	
Prevention of «venomous infection»	Drunk in white wine or fumes inhaled	William Salmon (1644-1713)

Table 2c: Summary of the medical applications of amber given by Lovell (1661).

Benefit	Application	Authority
Cattarhs	Unspecified	Lovell (1661)
Epilepsy		
Apoplexy		
Lethargy		
Vertigi		
Suffocation and inflation of the womb		
Flux of the blood		
Reduces «sperme» to its natural state		
«Helps the whites in women» [leucorrhea - white, yellow or green viscid vaginal discharge]		
Defluxions to the eyes	"globuls" held against the back of the head	
«Hinders distillations to the throat»	Worn about the neck	
Plague	Worn as an amulet and rubbed against the wrist ("pulses")	
Measles	"Sweet fixed Magisterie of Amber"	
Pleurisy		
«Comforts the heart»		
Helps with urinary difficulty	Drunk	
Helps «feavers»	Hung about the neck	
Helps the «vices of the eares»	Powdered with honey and oil of roses	
Helps with «vices of the eyes»	Powdered with attick honey	
Stomach ailments	Drunk in water	
Against «phantasies» in children	Worn as an amulet	
Fluxes of the stomach and belly		
Strengthens the bowels and other body parts	unspecified	
Prevents epilepsy	Drunk with wine	
Prevents resolution		
Prevents convulsions		
Prevents distension of the nerves		
Helps the pains of the stomach	Oil of Amber	
Helps the trembling of the heart	Unspecified	
Dries up the «phlegme of the head»	Breathe in the fumes	
Helps with parturition (childbirth)		
Convulsions		
Helps «infections of the aire»		
Cicatrices (surgical scars)	Unspecified	

Table 2d: Summary of the medical applications of amber during the late 17th and 18th century.

Benefit	Application	Authority
Apoplexy, Paralysis, Epilepsy	Oil of Amber wiped on the nostrils	Oswald Croll (1670)
Cramp	Oil of Amber drunk in water or inhaled as fumes	
Bladder stones	External application of Oil of Amber	
Eases childbirth	Oil of Amber drunk in water	
«Cold defluxions of the head»	Infusion in water or wine	
Obstetrical problems	unspecified	
Fainting, heart palpitations	Oil of Amber dropped onto sugar	
Fevers	unspecified	
Failure to urinate properly	Oil of Amber drunk in water	
Catarrh	Oil of Amber drunk in water	
Tooth Ache	unspecified	
Jaundice	Gargled with Plantain water	
Colic	Oil of Amber drunk in water	
Amenorrhoea	Oil of Amber drunk in Beer	
Contractures	Oil of Amber drunk in Water	
Vomiting blood	External application of Oil of Amber	
Vertigo	Oil of Amber drunk in water	
Scotoma (partial blindness)	unspecified	
Stupefaction of the Brain	unspecified	
Prickings of the side (?stitch)	unspecified	
Diarrhoea	Lozenges and Tablets	Pomet (1737)
Drives down the vapours		
Apoplexy	Applied on silk and cotton cloths	
Epilepsy	Tincture of Amber in Spirit of Wine	
Paralysis		
Wounds		
Bruises		
«Cold humours» in horses and man		
Convulsions		
Headaches	Salt of Amber taken with Spirit of Harts horn	Hill (1751)
Nervous and Brain disorders		
Palsy		
Hysterick and Hypochondriack fits	Taken with poached egg	Brookes (1763)
Gonorrhoea		
Dysentery		
Catarrh	External application of Oil of Amber	
Gout		
Restoring paralytic, torpid and weak limbs		
Bringing up blood		

Table 2e: Summary of the medical applications of amber during the late 17th and early 18th century.

Benefit	Application	Authority
Plague	Pulverised or distilled and mixed with wine	Passera (1688)
Poison		
Hydropism		
Worms		
White flux of the uterus		
All contagious diseases		
Catarrh		
Epilepsy		
Apoplexy		
Dizziness		
Lethargy		
Breathing problems		
Asthma		
Swelling of the stomach		
Heart disease		
Renal calculi		
Urinogenital problems		
Stomach ache		
Coughs		
Toothache		
Earache		
Throat inflammation	Inhalation of vapours	
Tumours		
Prevention of plague	Amulet worn on the wrist	
Against spells	Amulet worn on the collar	
Against enchantment		
Against evil sorcery		
Against demons		
Against night tremors and fears		
Fevers	Mixed with Rose Oil	
Gynaecological disorders	Oil of amber	
Wards off contagions	"Alexiterial stones" (pills)	Fuller (1710)
Pituitose affections of the head	Quilted night cap	
Rheumatic pain in the head		
Haemorrhoids	Unguent	
Epilepsy	Tincture	
Hysteric Passion		

5.4 Veterinary applications

In a rather unusual extension of the medical uses of oil of amber into veterinary science, Bartlet (1753) summarises the applications of amber preparations in the treatment of horses. Depending on the preparation, the oil of amber used here may have been employed either primarily as a binding agent or an active ingredient.

Purging was recommended for a variety of stomach and liver disorders, but occasionally did not work, causing the horse to "swell and refuse his food and water" (Bartlet 1753:18). Under such circumstances, warm diuretics were utilised in order to return the animal to health. Bartlet recommends a diuretic drink comprising a pint of white wine mixed with a dram of camphor "dissolved in a little rectified spirit of wine", to which was added two drams of oil of juniper, two drams of unrectified oil of amber, and finally either four ounces of honey, syrup or marshmallows (Bartlet 1753:18). An alternative treatment involved administering a 'diuretic ball' made up of one ounce of 'venice turpentine' incorporated with yolk of an egg, to which was added half an ounce each of juniper berries and powdered aniseed, and two drams of unrectified oil of amber, all fashioned into a ball with syrup of marshmallows (Bartlet 1753:19). The balls were recommended to be oval in shape and no bigger than the size of a 'pullet's egg'; larger doses were to be subdivided, and each ball dipped in oil in order to "make them slip down the easier" (Bartlet 1753:20).

Should a horse suffer from 'slow fever', a dangerous condition requiring considerable skill and knowledge on the part of the farrier, the letting of blood ("not more than three pints"; Bartlet 1753:37) was combined with the application of a dietary regimen devoid of oats and comprising mainly 'scalded bran'. If the animal responded to this treatment by urinating (the archaism 'staling') so little "as to occasion a fullness, and swelling of his body and legs", the following drink was recommended (Bartlet 1753:41:

> Take of salt-prunella, or nitre, one ounce; juniper berries or Venice turpentine, of each, half an ounce; make into a ball with oil of amber.

Bartlet (1753:58) notes that "settled habitual coughs …. frequently degenerate to asthmas, and broken-wind". Loss of appetite, wasting and weakness commonly lead to death of the animal, with a post mortem revealing the lungs to be "full of knotty, hard substances, called tubercles". Relatively fit horses were bled, followed by a course of 'mercurial medicines' and purges. The purge consisted of the following preparation (Bartlet 1753:61):

> Take gum-galbanum, ammoniaca, and assa foetida, of each two drams; fine aloes, one ounce; saffron, one dram; oil of aniseeds, two drams; oil of amber, one dram; with honey, enough to form into a ball.

Bartlet (1753:66-67) gives the opinion that 'broken-wind' is due to "injudicious, or hasty feeding". He suggests that the consequent differential growth of the lungs makes them too large for the chest cavity. Effectively incurable, the disease was treated by trying to mitigate the symptoms. This involved feeding the animal sparingly with corn "wetted with chamber lye" (archaism for urine; Bartlet 1753:71), encouraging moderate exercise, and giving an "alterative ball" (Bartlett 1753:73) once a fortnight. The ball was meant to alter the course of the disease and go some way to restoring health, and consisted of the following (Bartlet 1753:73-74):

> Take succotrine aloes six drams, myrrh galbanum and ammoniacum, of each two drams; bay-berries, half an ounce: make into a ball, with a spoonful of oil of amber, and a sufficient quantity of syrup of buckthorn.

A horse might also be affected by a "sympathy of nerves" (Bartlet 1753:82), which may in turn lead to "that universal cramp or convulsion" (Bartlet 1753:84), where all the muscles contract, giving rise to convulsions. Persistent cramping lead to the development of tendinous knots, and ultimately "all the muscles, both before and behind, will be so much pulled and cramped, and so stretched that he looks as if he is nailed to the pavement". Prolific blood-letting was combined, in these cases, with the use of a "nervous ball", administered twice a day and washed down with "a decoction of mistletoe, or valerian, sweetened with liquorice or honey". The ball itself was prepared from half an ounce of asafoetida, two drams of powdered Russian castor, and an ounce of powdered valerian root mixed with honey and oil of amber (Bartlet 1753:85). An alternative ball consisted of six drams of cinnabar of antimony, half an ounce of asafoetida, two drams each of aristolochia,

myrrh and bay berries, mixed with treacle and oil of amber.

In cases of paralysis, particularly of the limbs, Bartlet (1753:90) recommends an embrocation consisting of three ounces of rectified oil of amber combined with four ounces of oil of turpentine, two ounces each of nerve ointment and oil of bays, one ounce of finely rubbed camphor, and a similar amount of tincture of cantharides. The liniment was then applied liberally (to allow maximum penetration into the skin), and massaged into the back and loins.

'Gripes' are pains caused by trapped intestinal gases or full bladders. Treatment involved "emptying the strait gut with a small hand dipt in oil", and easing the neck of the bladder (Bartlet 1753:123). This was combined with the administration of a "ball for strangury in the wind cholic", containing Venice turpentine, juniper berries, salt prunella, salt petre, oil of juniper and salt of tartar, usually washed down with "a decoction of juniper-berries, or a horn or two of ale". Failure of the animal to release pent up colonic gases was approached by giving a second ball, this time with half a dram of salt of amber added (Bartlet 1753:124). An additional option was using the following 'glyster' (Bartlet 1753:124):

> Take chamomile flowers two handfuls; anise, coriander, and fennel seeds, of each an ounce;; long pepper half an ounce: boil in three quarts of water to two; and add Daffy's elixir, or gin, half a pint; oil of amber half an ounce, and oil of chamomile eight ounces.

"Bilious or inflammatory cholic" was marked by high fever and panting (Bartlet 1753:127). The condition was often fatal, but Bartlet recommends using an alterative ball in the case of "a horse of little value". In addition to two drams of oil of amber, the ball contained one ounce of diapente, half an ounce of diascordium, and two drams of myrrh powder. It was administered up to three times per day.

Loose bowel motions were responded to by moderate purging, but if accompanied by "gripings, the mucus of the bowels coming away" such that "he voids great quantities of slime and greasy matter", in addition to "losing his appetite and flesh", a drench was recommended, together with an alterative ball. The ball would contain oil of amber, either mixed with succotrine aloes, diapente and the juice of Spanish liquorice dissolved in water, or have the extra ingredients myrrh, saffron and rhubarb (Bartlet 1753:132-133).

A variety of parasitic worms and bots (botfly larvae) were known to infest horses, and Bartlet recommends the following purge to assist in ridding the animal of worms (Bartlet 1753:142):

> Take fine succotrine aloes, ten drams; fresh jalap, one dram; aristochia, or birthwort, and myrrh powdered, of each two drams; oil of savin and amber, each one dram; syrup of buckthorn, enough to form into a ball.

"Molten-grease" referred to oily discharge mixed with the faeces. Again, an alterative ball was employed as a purgative, containing an ounce of aloes, six drams of diapente and a spoonful of oil of amber. This was probably much more healthy for the horse than the antimonial alternative (Bartlet 1753:159).

Lastly, in cases of "The Grease" where the legs become so engorged with fluid that "the hairs stand up", and there is "a large stinking discharge from deep foul sores", oil of amber was used as part of a diuretic drink which also contained four ounces of yellow rosin and one dram of sal prunellae, mixed in a quart of 'forge' water, following a two hour period of fasting.

Beasley (1861:188) cites Roche's Embrocation as comprising "Olive oil, with half its weight of oil of cloves and oil of amber", while Darby's Oil consisted of "Equal parts of oil of amber, Barbadoes tar, and balsam of sulphur" (Beasly 1861:84).

6. Conclusions

The use of fossil materials as ingredients in both folk remedies and the pharmaceutical cabinets of professional physicians and apothecaries has a surprisingly long history. Pliny the Elder reports that they were in common use by the 1st century, implying an unrecorded pedigree that extends perhaps as far back as Theophrastus in the 4th century B.C. Even common ailments, now relatively simple to treat, caused considerable distress in historical times, and were exacerbated by poor diet, hygiene and living conditions. The Doctrine of Signatures, whose roots are firmly

based on Aristotelian principles, taught that readily available botanical, zoological and geological materials were valuable medicines whose efficacy could be identified from the correlation of their external form or properties with the body part which was diseased. Thus, the phallic form of the Lapis Judaicus or Jews' Stone testified to its value in the treatment of urinary disorders. Since the Toad Stone (Bufonites) was believed to originate in the skulls of mature toads, which were likewise famous for the poisons released from their parotid glands, it was naturally employed as an antivenin. It was not until the late 17th and early 18th centuries that these two medicines were fully appreciated as being the spines of fossil cidaroid echinoids and the palatal teeth of fossil fishes respectively.

Lapis Lincis or Lyncurium, believed to be the solidified urine of the Lynx, was used to treat a variety of renal and other ailments. Although there is some debate over the identity of these objects in early literature, it is obvious from some 17th and 18th century texts that belemnite guards were collected as Lyncurium. This is confirmed by the contents of the 18th century pharmaceutical drawers belonging to Sir Hans Sloane, physician to the London élite.

Amber, the fossil resin of coniferous trees, particularly in the Tertiary of North West Europe, was used as an ingredient in a wide range of simples as well as being utilised as a fumigant. Distilled after heating in a retort to produce Oil of Amber, and the sublimated crystals formed on the sides of the glassware were collected as the Salts of Amber. A second distillation or 'rectification' yielded Tincture of Amber, which was thinned with alcohol. Amber preparations are still commercially available today.

All four fossil materials have a long pedigree of medicinal use extending from classical times through to the late 18th century. It was only as the theories of lapidifying juices and lapides sui generis were replaced with a generally accepted, coherent explanation of 'formed stones' as the petrified remains of once living creatures that fossils vanished completely from the physician's materia medica.

Batman (1582:72) records that Apuleus "was taught by a divine power, that there were many kind of hearbes and stones, by the which men might get them an everlasting lyfe but that it was not lawful that men shuld have the knowledge of them". As a consequence, none of the great scholars who listed the various medicinal applications of these natural remedies was able to adequately explain the origins of their 'vertues', while admitting that "God, the beginning, the ende and originall of all virtues" is the source of their powers. And yet all agreed that "as Zachari writeth to Mitridates, that theyr great force, and mens destinies, are in the virtues of hearbs and stones" (Batman (1582:72).

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9. APPENDIX 1: Medicinal recipes using amber given by Oswald Croll (1670)

1. In the Pest, one drop morning and evening chased about the Nostrills prevents venomous infection. It is sometimes given from (backwards capitol E) Ej to Eij in Water of Carduus-bened.
2. It is exceeding profitable to such as are in danger to be afflicted with dangerous diseases of the Head, as the Apoplexy, Paralysis and Epilepsy. For if one or two drops of this Oyle be taken upon an empty Stomach in appropriate Waters, viz. of Betony, Tilia, Lavendar, Black Cherries &c there will be no fear of being invaded by those diseases. A like efficacious are Tablets of Rotula's made of Sugar, and mixt with some drops of this Oyle. And for any one that is already infested with the Apoplexy, Epilepsy or Paralysy, there is not a more excellent Remdy, than some drops of distilled Oyle of white Amber, infused in Epileptick Spirit and exhibited. It is also profitable to anoint the Neck and Nostrils with the said Oyle, and certainly the disease will be expell'd thereby, and the diseased speedily recover sence and motion; in like manner a perfume of the same white Amber, sprinkled upon burning coals, and conveighed to the Nostrils of the Epileptick in the time of the fit, very much abates it.
3. The Nerves, Veins, or Nervous parts, infested with the Cramp, or such like Contractures, may be profitably anointed with this Oyle. It is thus used, mix a little of it with Unguents, with which anoint the infected parts, by which the Nerves are wont to be restored.
4. One or two drops, mingled with Water of wild Alexander, and inwardly taken expels the Stone, and other superfluities of the urinal passages.
5. If Efs. Or Ej. be infused with Water of Mugwort, Vervain or Malmsey-Wine, and be drunk by a Woman in labour, it accelerates the Birth.
6. It is profitable in cold defluxions of the Head, for by the continued use of this they they are consumed, and the Brain comforted.
7. If the Nostrils, and pit of the Breast or Heart, be anointed with some drops of this Oyle, in Women which have suffocation, precipitation, and strangulation of the Wombe, it abates the motion of the Matrix. Of like efficacy are Rotula's of Oyle of Amber made with Sugar, if one or two of them be taken.
8. It also helps in swounings, Languishing and Palpitation of the Heart.
9. It comforts not only the Faculty of the Vital Virtue of the heart, but also of the Sanimal virtue of the Brain, and natural vigor of the Liver; and therefore in concoction and digestion it is of admirable use.
10. In fevers, three drops in Water of Carduus-bened, being taken before the fit, and the sick laid to sweat in bed, expels the Fever.
11. In retention of the Urine,three or four drops taken in Water of Strawberries or Wine, wonderfully provokes urine.
12. In drying up the Catarrh it is helpful.
13. Dolours of the Teeth, occasioned by defluxions, it cures, if mixed with Plantaijn-water, and the mouth gargled therewith.
14. In the Jaundies, it is given with Water of Endive, Bindeweed, Succory, Selandine.
15. In the Cholick, Ej or zfs given in Beer.
16. In suffocation of the Matrix, seven or eight drops in Water of Peneroyal.
17. In accelerating the Birth and after burthern, 7 or 8 drops in water of Savine, or Mugwort.
18. In retention of the Menses, 7 or 8 drops in Water of Melissa.
19. In Contractures, some Contractures of Hands and Feet have been resored by anointing with this Oyle of Amber.
20. In vomiting Blood, 3 drops in Water of Colts-foot, Tormentil, Sloes.
21. In Vertigo and Scotoma it cures.
22. Stupefaction of the Brain, it miraculously removes.
23. It comforts the Sight, with Water of Fennel.
24. In Prickings of the sides it is efficaciously adhibited.

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